Engineering Library

October 5, 1933

OCT 7 - 1933

Engineering News-Record

McGraw-Hill Publishing Company, Inc.

25 cents, $5 per year

Are Public Works Lagging?

Grave concern is felt over the lagging of the PWA re-employment program, keystone of the recovery arch. Washington delayed the campaign for two months; now it is charged that local communities are backward in putting their projects through. Many men fear that the program is a failure. What are the facts?

A countrywide telegraphic survey shows vigorous activity everywhere. The local communities are doing their part. The public-works program is not a failure. The PWA machine is in successful action. Approvals are going through in large numbers, and states and cities are ready with programs of work that represent a great reservoir of employment.

Thus, the outlook is definitely hopeful. But obstacles and delays remain to be removed: incomplete planning, obstructive laws, legal red tape, wage-rate confusion, taxpayers' fears and doubts. The intensive speeding up that is essential to the success of the program requires:

—a drive to complete local programs;

—legislative action to relax debt limits;

—elimination of red tape;

—preparation for continuous winter work;

—making plain to everyone that the city taxpayer must pay for breadline relief if he fails to support job relief.

Concern over the PWA program is not justified today, for progress is being made. But concern will be justified unless Washington and Centerville get together, with better spirit than now, to speed up contract lettings and the issuance of pay checks.

Page 412: Summary of Telegraphic Reports on

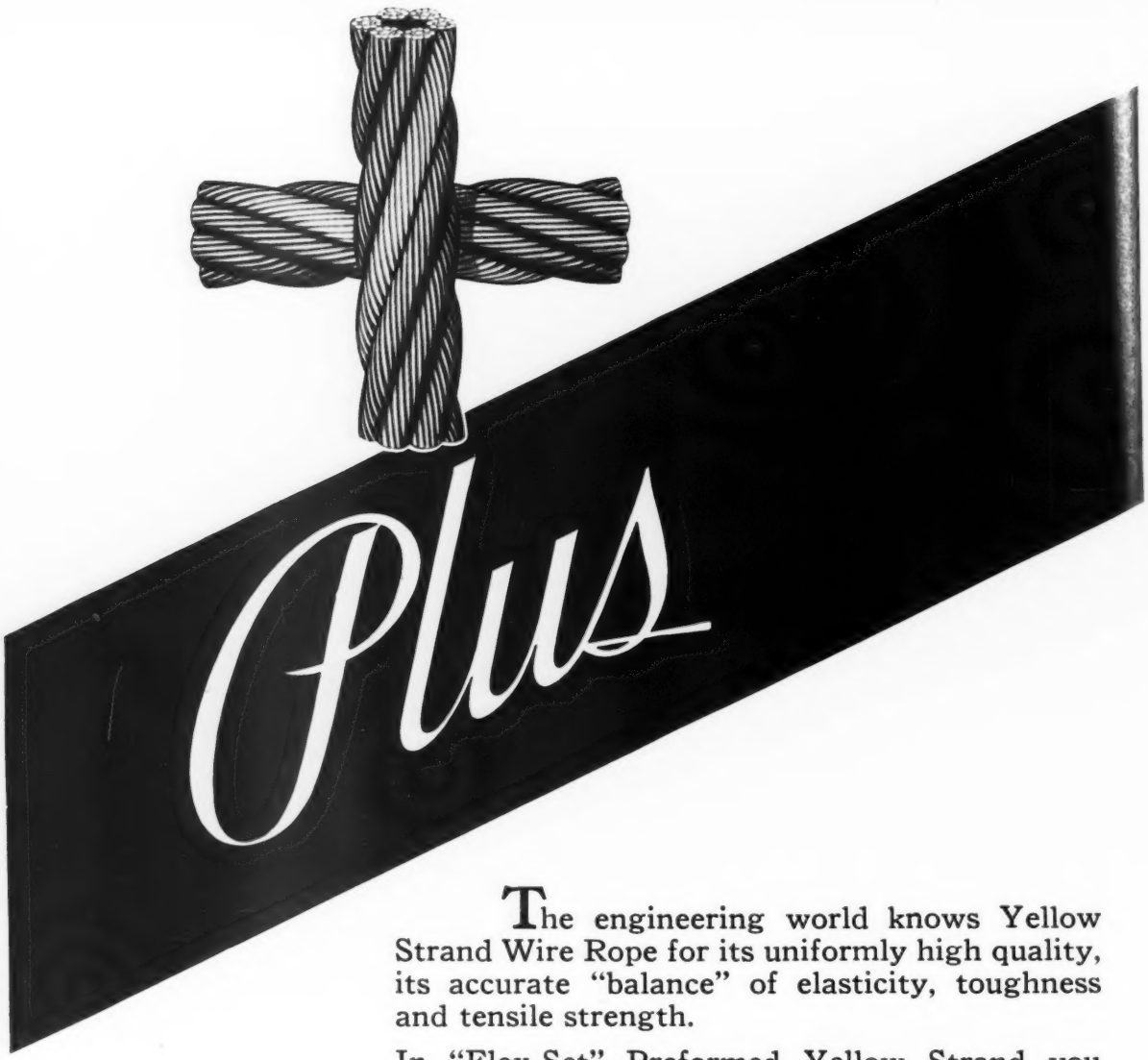
Public Works Progress and Delay

Also:

Public Works and the National Planning Board

Soil Sampling and Tests for the Foundations of the San Francisco-Oakland Bridge

. . . . . and important articles on dams, bridge problems and the contracting business



The engineering world knows Yellow Strand Wire Rope for its uniformly high quality, its accurate "balance" of elasticity, toughness and tensile strength.

In "Flex-Set" Preformed Yellow Strand you have all of these, PLUS the many advantages of preforming: easier handling, installing and splicing — less tendency to kink or bird-cage — less internal and external wear. In a word: LONGER SERVICE and LOWER FINAL COST. Try it.

NRA MEMBER U.S.
WE DO OUR PART

Broderick & Bascom Rope Co., St. Louis, Mo.

Branches: New York Seattle Portland Houston ∾ Factories: St. Louis Seattle

"Flex-Set" Preformed Yellow Strand Wire Rope

Editorial Staff
New York
V. T. Boughton
W. G. Bowman
C. S. Hill
F. W. Herring
H. W. Richardson

Engineering News-Record

A Consolidation of Engineering News, Engineering Record, The Sanitary Engineer and The Contractor

F. E. SCHMITT, *Editor*

Editorial Staff
Chicago
W. W. De Berard
San Francisco
N. A. Bowers
J. I. Ballard

Willard Chevalier
Publishing Director

Contents for October 5, 1933

VOLUME 111, NUMBER 14

Copyright 1933, by McGraw-Hill Publishing Company, Inc.

Cle Elum Dam Completes Storage for Yakima Project.... 397
BY ROBERT J. NEWELL

A-Frame Type Dam Readopted for Cumberland River.... 401
BY F. S. BESSON

Vertical-Lift Bridges With Synchronous Motors..... 402
BY W. L. SIX

Sampling and Soil Tests for Bay Bridge, San Francisco.... 404
BY DANIEL E. MORAN

Coordinating Central and Field Offices..... 407
Fifth of a series of articles on "Ten Business Problems of Contracting"
BY J. L. HARRISON

Compensation-Insurance Facts Important to Contractors... 409
BY R. TALBOT

Temperature Effect on River Flow Studied in Germany.... 410
BY SAMUEL SHULITS

PWA Planning Board Formulates Principles..... 411

The PWA Today: Is it a Failure?..... 412

Editorials.....418 News.....420
Business Notes .....424 Materials and Prices 426

Published every Thursday. Price 25c. per copy. Subscription, U.S.A., Mexico, Central and South American countries, $5 per year. Canada, including duty, $7.50. All other countries, $9 a year, or 45 shillings. Entered as second-class matter April 11, 1917, at the Post Office at New York, N. Y., under the Act of March 3, 1879. Printed in U.S.A. Cable Address "McGrawhill, New York." Member A.B.P. Member A.B.C. Copyright, 1933, by

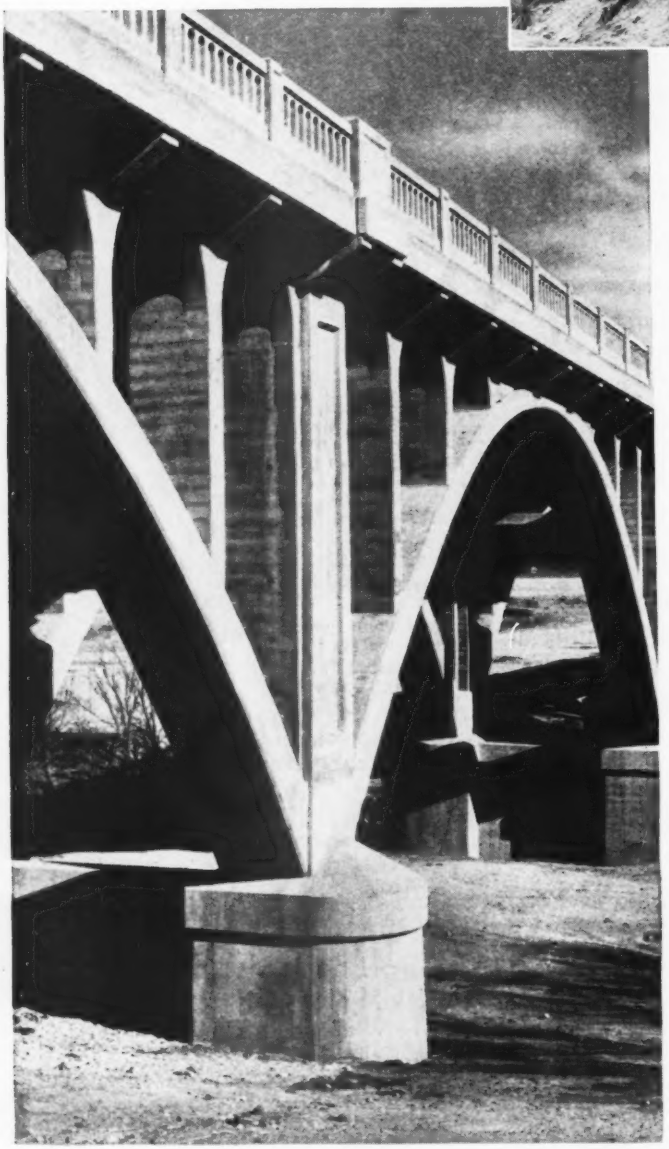
McGRAW-HILL PUBLISHING COMPANY, INC., 330 WEST 42d STREET, NEW YORK, N. Y.

Editorial and Publishing Offices: 330 West 42d St., New York; 520 North Michigan Ave., Chicago; 883 Mission St., San Francisco; Aldwych House, London, W. C. 2, England. Branch Offices: Washington; Philadelphia; Cleveland; Detroit; St. Louis; Boston; Greenville, S. C. James H. McGraw, Chairman of the Board; Malcolm Muir, President; James H. McGraw, Jr., Vice-President and Treasurer; Mason Britton, Vice-President; Edgar Kobak, Vice-President; H. C. Parmelee, Vice-President; Harold W. McGraw, Vice-President; B. R. Putnam, Secretary.

Printed by The Schweinler Press, N. Y.

SAVE——————

those dollars!



● *Bridge north of Hays, Kansas, on State Highway No. 1. Seven 80-foot open-spandrel arches. Kansas Highway Commission, W. V. Buck, Chief Engineer. LaMotte Grover, Bridge Engineer. Clark Seyer, Resident Engineer. A. L. Cook, Ottawa, Kansas, Contractor.*

● Concrete builds the best bridge for the least money!

Concrete was the logical choice for this highway bridge.

First cost was low. Future budgets are protected against heavy maintenance expense. Highway department records show annual cost of maintaining concrete bridges over the first twenty-year period is less than 0.6% of the construction cost — and only slightly more in subsequent periods.

Durability, safety in any weather, stability against floods, and beauty —you get all of these in the concrete bridge.

Information on bridge design and construction furnished upon request.

Write to Room 8101

PORTLAND CEMENT ASSOCIATION 33 W. GRAND AVE., CHICAGO
CONCRETE FOR PERMANENCE

Engineering News-Record

Vol. 111 New York, October 5, 1933 No. 14

Cle Elum Dam on the Yakima Project.397
A-Frame Dam for Cumberland River..401
Synchronous-Motor Lift Bridges.....402
Soil Tests for Bay Bridge Foundations.404
Business of Contracting—V 407
Compensation Insurance 409
PWA Planning Board Procedure ...411
Public-Works Progress and Delay....412
Editorials 418
News of the Week.....420
Business News 424
Materials Prices 426

❖

Cle Elum Dam Completes Storage For Yakima Project

Rolled-earth embankment 130 ft. high provides final reservoir for Yakima Valley irrigation development—Outlet tunnel driven through gravel and sinking of gate shaft are construction features—Borrowpit material rolled in 6½-in. layers to compaction of 134 lb. per cubic foot

By Robert J. Newell
Construction Engineer, U. S. Bureau of Reclamation

TO PROVIDE the last and largest of a series of six storage reservoirs to meet the requirements of the Yakima Valley irrigation development the Bureau of Reclamation is building the Cle Elum Dam at the outlet of Lake Cle Elum on the Yakima River. The structure is a rolled-earth embankment with a supporting downstream fill of gravel, and is 130 ft. high and 750 ft. long on the crest. It will store 356,000 acre-ft. to spillway level, and the reservoir capacity can be increased to 435,700 acre-ft. by the addition of spillway gates. Construction interest centers in the driving of the outlet tunnel through gravel, the sinking of the gate shaft and the building of the enlarged connection of shaft and tunnel.

The natural lake and the reservoir site is on the Yakima River about 100 miles southeast of Seattle and high upon the east slope of the Cascade mountain range. The catchment area consists of 200 square miles of mountainous region, producing an average flow of 640,000 acre-ft. per year or 5 ft. in depth over the drainage area. While the winters are long and the snowfall is heavy, these construction handicaps are offset by the accessibility of the site from improved highways and railroad, the near supply centers on Puget Sound and telephone and power service already available.

Fig. 1—Cle Elum Lake and reservoir site looking upstream from the dam and showing the trash rack of the outlet tunnel (lower left) which takes the flow of the Yakima River during construction.

Dam design

The outflow channel from the lake has cut through an obstructing gravel ridge of glacial origin that extends across the narrow valley. No bedrock for foundation was found at reasonable depth, and a rolled-earth structure was selected. The crest elevation was fixed at about the top of the supporting gravel ridge, and the outlet was lowered 10 ft. below streambed to increase the live storage. The lake side of this ridge, during a reputed ancient high-water stage, was

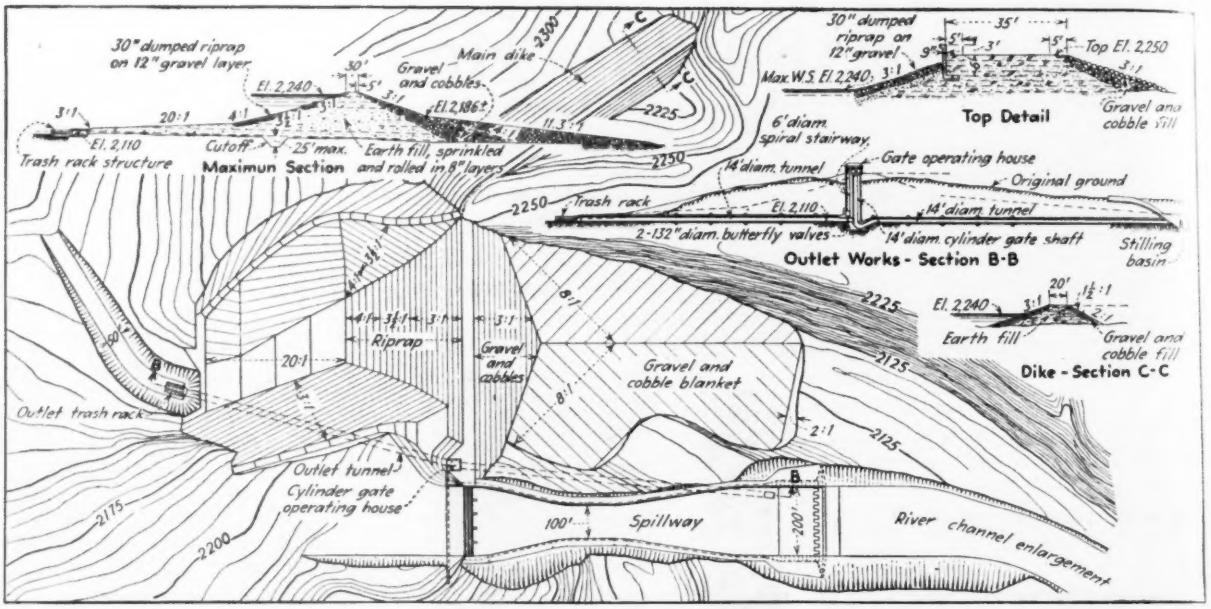


Fig. 2—Plan and sections of Cle Elum Dam spillway, outlet tunnel and control works.

covered with an impervious layer of sediment from 25 to 40 ft. thick, which is being depended on for water-tightness.

The dam structures comprise a diversion and outlet tunnel, the dam embankment and a spillway. The tunnel, which is driven through the right abutment, is 1,800 ft. long and 14 ft. in finished diameter. Outflow is regulated by gates located in the bottom of a shaft intersecting the tunnel at about mid-length. Tandem cylinder operating gates are protected by a pair of emergency valves of the butterfly type.

The embankment is 130 ft. high and about 750 ft. long on the crest. The cross-section is quite conservative, with a heavy impervious section of earth on the upstream side backed by a large volume of free-draining gravel and cobbles (Fig. 2), providing a total base width of 1,700 ft. The sides and bottom of the river channel where gravel is exposed are covered by blankets of earth on the upstream side to connect with the impervious lining of the reservoir basin, and with blankets of gravel and cobbles on the downstream side. The upstream face of the dam is protected from wave action by rock riprap, 30 in. thick, dumped on a 12-in. layer of gravel.

The spillway is an open channel, 200 ft. wide, built of reinforced concrete over the right abutment. Discharge into the river channel below the dam is through a stilling pool provided with a dentated sill at the outlet to quiet the turbulence of the outflow.

Construction sequence

The principal items of the construction schedule include:

Stripping	135,000 cu. yd.
Tunnel and shaft excavation	21,000 cu. yd.
Other excavation	1,547,000 cu. yd.
Embankment	1,371,000 cu. yd.
Riprap	53,000 cu. yd.
Concrete	31,000 cu. yd.
Metal work	2,000 tons

The contract was awarded in August, 1931, and preparatory work was begun at once. Any logical sequence of construction required as the first step the completion of the outlet tunnel to provide for stream diversion during the construction period. Further, it was necessary to complete the tunnel early the following season to allow the embankment to be built high enough during the succeeding summer and fall to be safe from overtopping by flashy floods in November and December.

However, the permanent outlet for the tunnel, including the stilling pool and the channel leading to the river, involved the excavation of several hundred thousand cubic yards of material, which was required to be placed in the embankment but could not be so placed until after the river was diverted through the tunnel. Therefore, to avoid the rehandling of such a large yardage of material and to get the tunnel work quickly under way, a temporary outlet for diversion during the first season was provided by an adit diverging from the tunnel near the lower end and discharging into the river channel just below the toe of the dam.

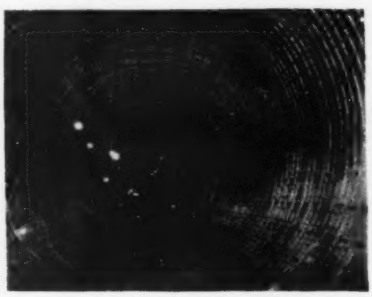


Fig. 3—A 19-ft. diameter outlet tunnel 1,800 ft. long was driven through gravel, using steel liner plates. A 30-in. lining of reinforced concrete was placed inside the plates.

The tunnel and gate shaft were excavated, lined and grouted, and the gates were installed between September, 1931, and May, 1932. The river was diverted through the tunnel late in June, 1932, when the spring flood receded to a stage that could be bypassed without building up a high head. During the next four months all efforts were concentrated on the dam, and 80 per cent of the embankment was completed by the end of October. During October and November the outlet excavation was completed and the stilling pool was constructed, allowing the adit to be plugged and the tunnel flow to be turned through the permanent outlet. Work was then shut down for the winter, completion of the job awaiting the following summer season.

Tunnel construction

The tunnel was driven from both ends to meet at the shaft and was excavated to 19 ft. in diameter. The material encountered throughout was a more or less compacted gravel carrying considerable water, and no blasting was required. Steel liner plates were used instead of timbering to support the ground. These plates, stamped out to the curvature of the tunnel section, were 37 11/16 in. long by 12 in. wide and ¼ in. thick, with flanges along the sides and ends 2 in. deep bored for ¾-in. bolts. The plates were placed in rings around the tunnel, and joints in adjacent rings were staggered to increase rigidity.

Temporary timbering was used to support the plates until each ring was completely bolted up, and usually for an additional period until the roof had settled solidly around the crown. Space for one plate only was excavated at a time. The crown was carried from 1 to 1½ in. high, and the upper quarter points were drawn in slightly to allow for settlement. Space behind the plates was

kept as small as possible and was packed with pea gravel as the plates were set and bolted up.

For convenience in placing the liners, backfilling behind them and pumping out the bottom of the circle, a sequence was evolved wherein one ring was started at the top and carried down each side to a closure at the bottom, and then two rings were started at the bottom and carried up each side to a closure at the top. One plate in each ring was drilled and tapped for a grout connection, but

Fig. 4—Dam embankment compacted with sheepsfoot rollers in 6½-in. layers. The compacted material weighed 134 lb. per cu.ft.

it proved easier to burn a hole with a torch and weld in a connection where it was most convenient.

The face was kept breast-boarded to check airslacking and sloughing. The material was excavated by pick and shovel and air spades and loaded into cars by mucking machine. Pumping stations were installed at each portal, and a small pump was kept near the face. No artificial ventilation was required. The maximum progress was 12 ft. per heading per day of three eight-hour shifts; the average was from 9 to 11 ft.

Liner plates on the Cle Elum job cost nearly $40 per linear foot of tunnel laid down. Their strength was apt to be diminished by overreaming the bolt holes through the flanges to make them bolt up more easily. The use of timber would have permitted a little faster progress and in this locality would have been less expensive. However, the steel plates made a fine clean-cut section (Fig. 3) to receive the concrete lining, with no excess thickness of concrete at any point, no encroachment on the concrete section by timber which would eventually rot out and with convenient anchorage everywhere for forms and reinforcing bars.

The tunnel was lined inside the plates with 4,500-lb. concrete, 30 in. thick, reinforced with two rings of 1-in.-square bars spaced 6 in. apart. Cutoff collars of concrete 4 ft. wide surrounded the tunnel section at 100-ft. intervals to act as seepage stops. The lining was placed by a concrete gun, the entire circle being shot in one operation. While vibrating of the forms was resorted to, the main reliance in securing dense concrete was placed on a puddling crew working directly in the concrete until the forms were sealed up for the last few batches at the crown.

The concrete contained 1½-in. maximum size aggregate and was mixed to slumps of 4 to 6 in. The forms were made up in narrow panels 20 ft. long; when stripped, they were moved forward on barn-door track hung from forms in place. The concrete lining was poured in 20-ft. sections, one section being completed each 24 hours. One shift was required for clean-up and placing steel, one for formwork and the third for concreting.

Finally, the zone outside the lining was thoroughly grouted. The pressure tunnel upstream from the control gates in the shaft for a length of 250 ft. was further reinforced against leakage by a steel lining inside the concrete. This lining is made up of ⅜-in. sheets with all joints welded.

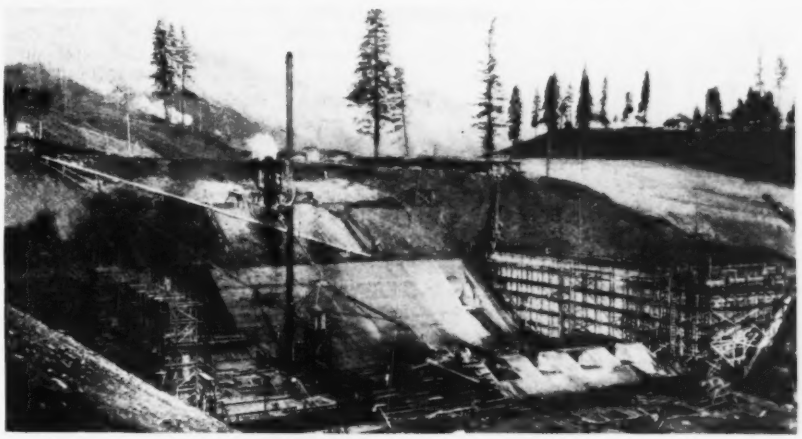


Fig. 5—The spillway leads to a stilling pool with a dentated sill, shown under construction, and an excavated channel enlargement directs the flow downstream from the toe of the dam. The downstream slope of the dam is shown at the right.

Shaft construction

The depth of the shaft excavation from original ground surface to the foundation was 140 ft., the foundation being 25 ft. below the tunnel invert. The lower part of the shaft structure is flared to reduce the possibility of settlement. As part of the excavation it was necessary to make an enlargement of the shaft near the tunnel level for the butterfly valve chamber and control room. The contractor elected to carry down the larger shaft, practically 32x48 ft., from the surface rather than to spread out and undercut 550 sq.ft. in a gravel formation at a depth of nearly 100 ft.

Steel sheetpiling was used to support the excavation and was driven from the surface to the foundation, sections being added until the necessary depth was secured. Driving became very difficult near the end, and probably the approximate limit of depth for the plan adopted was reached. Part of the excavation was done with a clamshell bucket, but for the most part the material was picked loose and loaded into dump buckets by hand. Two 25-ton derricks were set at the top of the shaft, one to handle timber and hoist muck and the other to set and drive piling. Later both handled concrete and steel. The inflow of water reached a maximum at the bottom of 1,400 gal. per minute, which had to be pumped against a head of 140 ft.

The flared base for the shaft, the wide transition inlet from the tunnel upstream and the gooseneck-shaped outlet to the tunnel downstream were slow, difficult jobs requiring infinite care to prevent disaster from caving ground. No permanent timbering was used, all posts, ribs and lagging being of steel shapes welded together as placed. Eighty tons of steel were used in this work at the bottom of the shaft in addition to the sheetpiling driven from the surface.

The concrete in this structure was

heavily reinforced, and the rings of bars used in the transition to the gate chamber were both lapped and welded. In the gooseneck outlet the upper half of the circular section was excavated and the concrete lining placed first, the lower half being excavated later and the concrete poured in short sections. Satisfactory results were thus obtained with less ground needing support at any one time, although it required a large amount of bending and straightening reinforcing bars.

As an added precaution in case of settlement of the shaft, a construction joint was made in the concrete and steel linings of the tunnel at the inlet and outlet faces of the shaft. Where this construction joint cut into the tunnel bore, it was safeguarded by a steel pocket, in halves, containing a rubber gasket about 4x6 in. in section and extending entirely around each tunnel. Outside of this gasket a grout pocket was cored out to be pressure-grouted after the shaft had had time to settle. It is notable that no serious accident occurred throughout this difficult and hazardous tunnel and shaft work.

Embankment construction

Gravel and cobbles for the downstream part of the dam were secured from the stilling basin and outlet channel excavation. Impervious material for the upstream section of the fill was borrowed from the top of the ridge forming the right abutment, the ridge being cut down to the level of the top of the dam. The borrowpit was found to be more or less compacted, test logs generally reading hardpan. The material was silt, sand and gravel with a little clay and occasional boulders, which were laid aside for use as riprap.

To excavate the rounded ridge down to a level surface, it was necessary to work against a face varying from nothing to 45 ft., and light blasting generally proved economical. The material broke in large chunks to some extent but readily crumbled under the rollers on the fill.

After considering various methods of conveying the earth from the pit to the dam and spreading it, the contractor selected ordinary pneumatic-tired trucks as being the most dependable and elastic equipment. The excavation was done by four shovels and one dragline, with capacities varying from 1¼ to 3½ cu.yd. The output reached a maximum of 7,000 cu.yd. per shift and 300,000 cu.yd. per month; 1,000,000 cu.yd. were placed in the fill in four months. The equipment was worked two full eight-hour shifts, which left a short third shift for repairs to shovels and rolling stock. A varied assortment of trucks was used, with capacities from 3 to 9 cu.yd. The larger sizes proved more economical when rugged enough to endure the service, and trucks equipped with ten wheels could negotiate the fill in a wetter condition than could the smaller ones.

The average haul was about 2,000 ft. All the borrowpit material was hauled downhill, while most of the gravel and cobbles were hauled uphill from the outlet works to the top of the embankment. Grades were kept below 10 per cent as far as possible. A 4-yd. truck hauled and spread about 160 yd. per shift, and an 8-yd. truck handled practically twice as much.

Material was spread on the embankment by the trucks in windrows parallel to the axis, and was levelled and compacted by roller units, each consisting of a 60-hp. tractor pulling a leveling scraper followed by a water-ballasted sheepsfoot roller. The scraper could be raised or lowered to vary the thickness of the layer, which was specified not to exceed 8 in. and actually averaged about 6½ in. One of these units could properly spread and compact from 2,000 to 2,500 cu.yd. per eight-hour shift and keep the embankment surface level and smooth. However, much depended on the skill and energy of the operator. Compaction was aided by the action of the trucks on the fill, each being routed over a new track (Fig. 4).

The natural moisture in the borrowpit was sufficient at the beginning of the season, but later sprinkling was necessary in increasing quantity. Before each layer was dumped, the surface of the fill was thoroughly wetted from hose lines, and the new layer was sprinkled before being leveled and rolled. The borrowpit grading proved satisfactory, although the material varied somewhat in character, which required the routing of trucks to different parts of the embankment.

Samples from the pit were taken frequently to be tested for grading, and a daily check was made on the embankment to determine the amount of water used and the degree of compaction secured. The material used showed maximum density when placed with about 15 per cent of moisture, but this amount kept the surface of the fill too wet for truck travel. The average of samples taken from a 2-ft. depth in the fill contained 11 per cent of moisture and weighed 134 lb. per cu.ft.

Miscellaneous operations

A good quality of volcanic rock for riprap was obtained from a quarry near the dam site.

During the fall of 1932 the stilling basin at the lower end of the spillway was excavated and built. The adit was then plugged and the river flow turned through the permanent tunnel, including the stilling basin and new outlet channel. In building the high counterforted walls for the stilling basin (Fig. 5) it was found that the low price of form lumber made its salvage an extravagance, so that most of the lumber was used but once.

In addition to building the dam, the project included the clearing of about 2,700 acres of timber and brush and the building of 5½ miles of road to replace a section of county road that will be submerged. The clearing and road change represented 10 per cent of the total cost.

Personnel—Elwood Mead, commissioner of reclamation, Washington, D. C., is administrative head of the reclamation bureau. All engineering and construction work is supervised from the Denver office, where R. F. Walter is chief engineer, S. O. Harper assistant chief engineer, and J. L. Savage chief designing engineer. The writer is construction engineer on the dam.

Contract was awarded to Winston Bros., Minneapolis, Minn., on a bid of $1,320,000. W. H. Gardiner, Western manager, was in charge of the work for the contractor, with Ralph Kennan as superintendent.

Expressing a Storm-Sewer Lateral Job in Man-Hours

IN WORKING OUT labor requirements for the proposed $660,000 Park Hill storm-sewer laterals in Denver, Colo., the engineers used a former completed job of $1,000,000 having similar characteristics and on which detailed records had been kept. The following table gives the labor required to produce the materials, manufacture and deliver them on the job. The number of men is based on an 8-hour day, 5-day week over a period of 5 months.

Cement—All cement required for concrete pipe, 27-in. to 39-in., mortar for concrete and vitrified pipe joints and manholes (16,030 bbl.), 13 men.

Sand and Gravel—All sand and gravel required for making concrete pipe, mortar for pipe joints, inlets and subdrain (5,500 cu.yd. sand and 7,500 cu.yd. gravel), 8 men.

Steel—All steel required for reinforcing concrete pipe and inlets (155 tons), 12 men.

Concrete Pipe—Making all concrete pipe, 27-in. to 39-in., and trucking to job (45,551 lin.ft.), 51 men.

Clay Pipe and Brick—Mining, moving and loading materials, making pipe and brick, loading, trucking and unloading at job (155,529 lin.ft. pipe, 580,000 brick) 150 men.

Manhole and Inlet Castings—All manhole rings and covers and steps, inlet rings and covers, hoods, steps and gutter gratings and frames, 15 men.

Sewer Construction—Construction of sewer lines, manholes, inlets, connections and flushing, cleaning up and incidental work, 325 men.

Surfacing and Oiling Streets—Producing necessary amount of surfacing material, taking up old surfacing and relaying old and new material (76,500 sq.yd.), 32 men.

Paving—Taking up old paving, mixing raw materials, trucking and laying new pavement, 6 men.

Total Number of Men Required—612.

In the above statement of labor involved no consideration was given to the following items which would create an additional amount of labor difficult to estimate: railroad transportation, fuel production and power production at manufacturing plant, and maintenance of production machinery and trucks.

The Park Hill lateral contract is in the $5,000,000 program for which Denver is asking for a federal PWA loan with a 30 per cent grant. The work is in charge of A. K. Vickery, city engineer.

A-Frame Type Dam Readopted for Cumberland River

A-frame crest installed on navigation dam in Cumberland River increases head 4½ ft. and gives harbor at Nashville, Tenn., a 9-ft. navigable depth

By F. S. Besson
Major, Corps of Engineers; District Engineer, Nashville, Tenn.

THE Nashville District of the Engineer Department, U.S. Army, has adapted A-frames to Cumberland River dams as a basis for improving navigation facilities on the stretch from the mouth on the Ohio River to Nashville, a distance of 191 miles. On this stretch of the river there are at present seven navigation dams with locks.

Now that Dam No. 52 on the Ohio backs water into and provides a channel 9 ft. deep for 44 miles up the Cumberland to Dam F, shippers have made numerous efforts to add to the present volume of traffic on the Cumberland. It has been a stumbling block that at low water there is less than 6 ft. over rock ledges in the Cumberland navigation pools, with a minimum of 4½ ft. over one of the ledges in Pool A. If the river is to take its place as a satisfactory link in the Mississippi system, its less than 6-ft. channel must be increased to 9 ft.

Experience with A-frames

During the summer of 1931 the Nashville District, in order to provide a 9-ft. depth in Nashville harbor, raised the crest of Dam No. 1, which is located just below the city limits. This work brought back to being the A-frame movable crest, which, except for some small examples on the Kentucky River, had been discarded years ago in favor of bear traps, roller gates, boule gates and chanoine wickets.

The unfortunate installation, tried out more than 40 years ago, that put A-frames on the blacklist was that at Dam No. 6 on the Ohio River. After the engineers had completed the construction at this dam, operators lowered the frames but once and had to build a cofferdam, pump out the water and shovel away the accumulated gravel before they could raise the frames. Thereafter the frames were never again lowered.

Unjustifiable weight has always been given to this failure. In fact, the A-frames at Dam No. 6 were not on the crest of a dam, but were seated deep in the bed of the river. A gravel bar was dredged away in order to place the frames. After their completion the bar reappeared, and, banking up both on the upstream and downstream sides of the frames, buried them. From this experience arose the tradition that A-frames are impracticable because they collect sand and gravel.

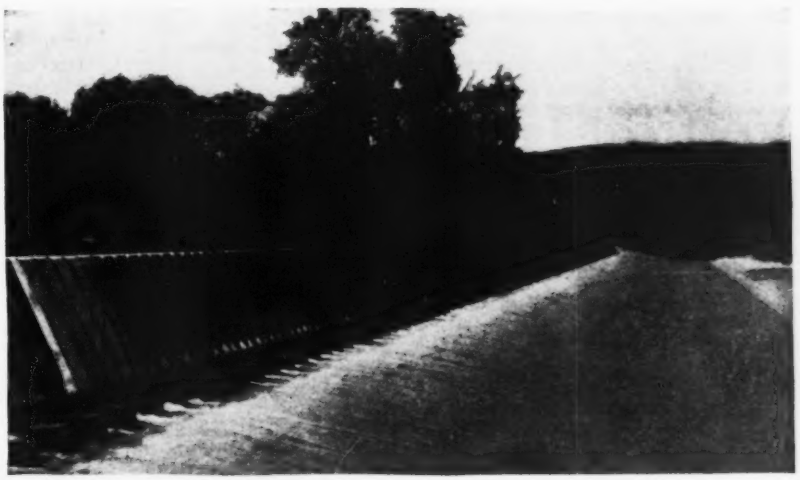


Fig. 1—Movable A-frame crest on navigation dam No. 1, Cumberland River at Nashville, Tenn.

Also, early designs for A-frames called for them to work against an 8- to 10-ft. head of water. Because of this depth of water and resulting swift currents, the designers felt that operators, with any kind of a boat-hook contrivance, could not catch hold of the down A-frames to hoist them upright. Accordingly, the designers tied the frames together with chains and supplied a hoisting chain with ratchets and pawls so that operators could hoist the frames, successively one after another, by using a winch on the lock wall. These chain systems were complicated, and when a chain broke in midstream operators repaired it only with considerable labor and difficulty.

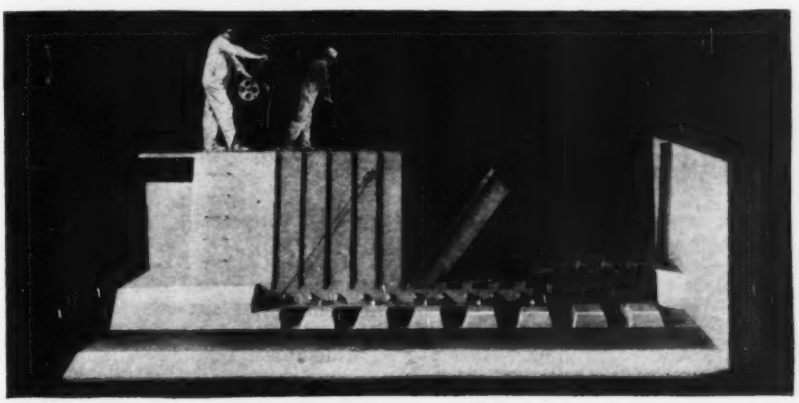
Thus today the only example of A-frames available as a precedent for the Cumberland comprises those frames on the Kentucky River operating against but a 2-ft. head. The designers of these Kentucky River frames limited the head to 2 ft. so that operators wearing rubber boots could walk out in the current, clean away debris and insert a lifting hook by hand in a small eye for hoisting.

Dam No. 1

For the Cumberland River the Nashville District decided to depart from the limiting conditions of A-frame operation, which determined the maximum head to be 2 ft. Fig. 1 shows that Cumberland River A-frames provide a 4½-ft. head, with a 1-ft. freeboard. When in the down position, large handles project upright so that an operator standing on the up-frames can readily hook and hoist the down-frames.

After the completion at Dam No. 1 of A-frames, similar to those shown in Fig. 2, the construction force lowered all frames for the high-water season. Then a barge dumped several loads of

Fig. 2—Model of A-frame movable dam, showing method of operating frames.



bar-run gravel on top of the frames, in order to find out if gravel and sand would interfere with operation of the frames. The frames were subjected to river wash for several months until a fall in the river permitted the operators to hook the frames. They raised the frames with ease.

In Fig. 1 the weir opening is shown at the far, or abutment side, of the dam. A-frames may be dropped from both the abutment side and the lock side. Accordingly, the weir opening may be spotted at any location, lock side of the dam, abutment side or in the middle of the dam. Ability thus to spot the weir opening makes it possible to eliminate eddies at the lower lock entrance.

Manipulation of the width of weir opening with A-frames gives perfect control of pool elevations for the Cumberland River at less cost of installation, operation and maintenance than any other type of crest that could be chosen.

Vertical-Lift Bridges With Synchronous Motors

Principal design problem is to eliminate jamming in the guides when span gets out of level—Positive chain drives and safety devices operating independent of the main operating machinery suggested as solutions

By W. L. Six

Contracting Engineer, The Mt. Vernon Bridge Co., Kansas City, Mo.

ALTHOUGH much progress has been made in improving the efficiency of the relatively new synchronized-motor type of vertical-lift bridge, its operation is not yet entirely free from trouble, particularly that caused when the ends of the span get out of level. The purpose of this article is to present a brief history of some of the steps that have been taken to overcome this serious objection, and at the same time to present the writer's thesis that the difficulty arises from defective mechanical control of the electrical synchronizing devices. Most attempts to remedy the situation have been in the direction of improvements in the electrical equipment itself—that is to keep the motors at the ends of the span in perfect step and thus to keep the lift span level. The writer believes that the problem has not yet been solved because creeping of the ropes on the counterweight sheaves is still possible, even if the motors are perfectly synchronized, and this will cause the span to get out of level and cause jamming in the guides. A positive chain drive and/or safety devices operated independently of main machinery should eliminate the trouble.

In this type of bridge all operating machinery is on the adjacent fixed spans, there being a lifting motor at either end of the movable span. The devices for indicating the relative elevations of the two ends of the bridge when it is being raised are governed by a shaft in the train of gears between the motors and by the racks on the counterweight sheaves. A very small motor in each tower is attached to the same shaft through gearing so as to make one revolution or some fraction thereof during the lifting or lowering of the span. The corresponding motor in the operator's house is made to revolve with this small motor and to maintain the same angle of revolution. This method of operation of vertical-lift bridges has been in existence only about eight years and was first introduced by I. L. Simmons, bridge engineer of the Rock Island Railroad.

The first bridges constructed employed the Selsyn or Synchronoscope (different trade names) to indicate to the operator the relation of the two ends of the bridge. If the indicator showed that the bridge was out of level, the operator, by manipulating a lever, threw resistance in the motor that was ahead, retarding its travel until the indicator showed the bridge to be in a level position again. To eliminate the human element in this method of operation, the electrical companies next improved their synchronizing devices so that resistance automatically would be thrown in the motor that was ahead, until the total revolutions of the motors on each end of the span were the same.

This change constituted an improvement but did not entirely eliminate the tendency for the spans to jam in the guides. In this type of bridge the motors are not positively connected to the moving span, but instead are connected through a train of gears to racks on the counterweight sheaves. The motors turn these sheaves in the required direction, and friction between the sheaves and the counterweight ropes is depended upon to lift or lower the span. Under normal conditions the friction is adequate to prevent any slipping, but when the ropes are wet or covered with ice, slipping or creeping sometimes occurs, and under these conditions the indicators fail to show the relative positions of the two ends of the span. For example, if there is slipping on one end of the span, the indicator, which is a measure of motor revolutions, will show that end to be ahead when in reality it is behind; the operator of the device, or the automatic device, as a consequence, will not make the proper adjustment.

Other improvements were made by the electrical companies, and on the M.K.&T. Railroad Bridge at Boonville, Mo. (*ENR*, May 26, 1932, p. 755) motors were utilized that would synchronize without depending on either the operator or an automatic device in the operator's house. Two of these motors, one on each tower, are the operating motors. The other two motors, one on each tower, are the synchronizing motors. The two motors in each tower are keyed to a continuous shaft. The electrical energy is applied to one motor only on each tower. The secondaries of the other motors are electrically connected together, "which furnishes an electrical tie between the two ends of the bridge

Fig. 1—Missouri River crossing of M. K. & T. Railroad at Boonville, Mo., a modern synchronous-motor-operated lift bridge in which the machinery is on flanking fixed spans. The operator's house that appears to be in the center of the span is on a swing span of an adjacent bridge.

as though a shaft connected them." If the unbalanced load on one end is considerably more than on the other end, the heavier loaded motor will tend to lag, and part of the energy in the light loaded motor is transmitted through the synchronizing motors, aiding the motor with the heavier load. However, even with this arrangement, any slipping of the counterweight ropes on the sheaves will cause the span to get out of level.

For this bridge the writer submitted the proposal to use direct sprocket chain drives instead of driving the counterweight sheaves at the ends of the moving span (Fig. 3), and also two alternate proposals to control all operating signals and safety devices independent of the main machinery. One of these latter two proposals contemplated operating the control motor of the safety devices from the shaft of a sprocket wheel in the machinery house, which was to be driven by a chain with one end connected to the bridge counterweight while the other end was dropped through a vertical pipe and counterweighted with a 1,000-lb. lead weight (Fig. 2). The second proposal for controlling the safety devices was to connect the main counterweight and the end of the moving span by a chain passing over sprocket wheels set between the counterweight sheaves in the machinery house. This is the alternate noted on Fig. 2. Electrical indicators and safety devices were to be controlled from these sprocket wheels.

The second proposal was adopted as an extra safety device on the Boonville bridge by the engineers of the railroad.

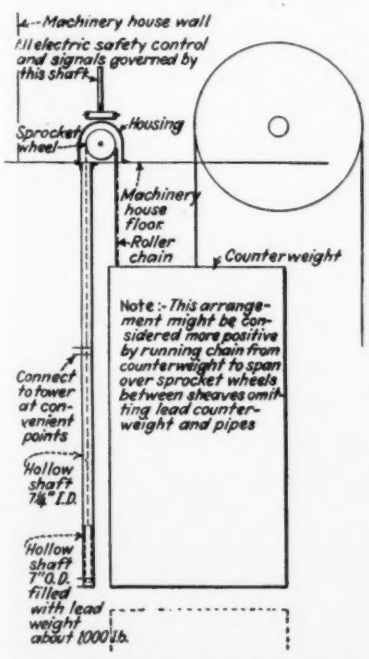

Machinery house wall
All electric safety control and signals governed by this shaft
Sprocket wheel
Housing
Machinery house floor
Roller chain
Counterweight
Note:-This arrangement might be considered more positive by running chain from counterweight to span over sprocket wheels between sheaves omitting lead counterweight and pipes
Connect to tower at convenient points
Hollow shaft 7¼" I.D.
Hollow shaft 7" O.D. filled with lead weight about 1000 lb.

Fig. 2—Proposed arrangement for operating safety device independent of the main machinery. An alternative arrangement, as used on the Boonville Bridge, is suggested on the drawing.

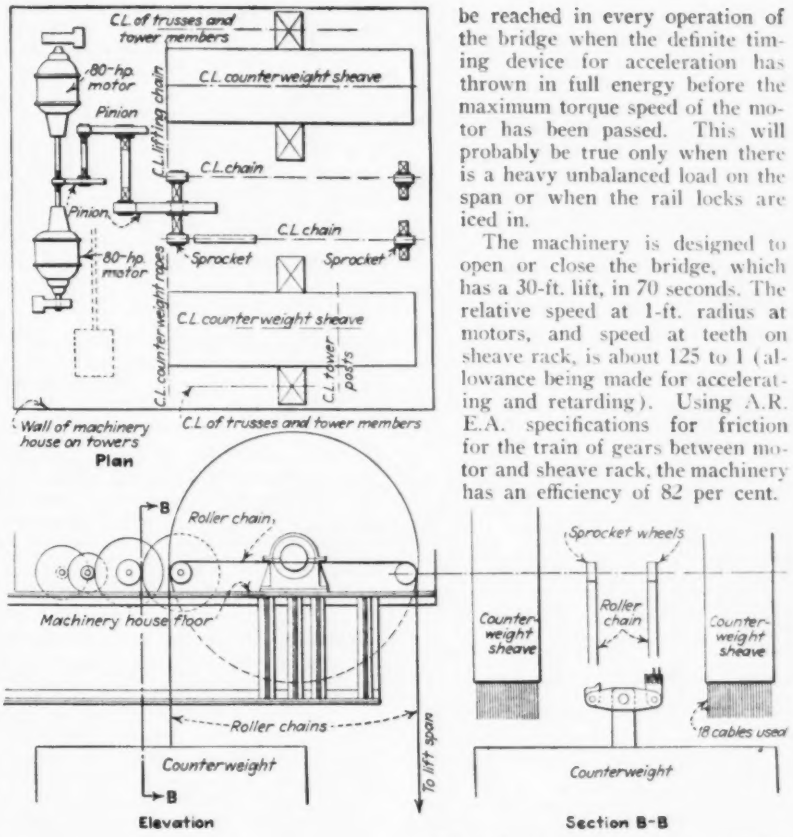


Fig. 3—Sketch of machinery for a proposed positive-chain-drive lift bridge.

In its operation the device does not govern any visible indicator but does control a Selsyn apparatus that will stop the machinery when the bridge is 6 in. out of level even though this results from slipping of the counterweight ropes.

The Boonville bridge therefore, in the opinion of the writer, represents an improvement over previous synchronous-motor-type bridges, but he contends that all electrical indication and safety devices should be controlled from the device that is operated independent of main machinery, especially if positive chain drive is not employed. In support of this contention, the following condensed calculations based on the Boonville bridge as typical are presented to show that there is not sufficient friction between counterweight sheaves and ropes to prevent slipping during certain weather conditions:

	Lb.
Weight of lifting span	2,000,000
Weight of counterweights	2,000,000
Weight of ropes	32,000
Total weight on sheaves	4,032,000
Total load on two sheaves (either end of bridge)	2,016,000

Motor Specifications

Four 80-hp. motors—600 r.p.m. (Two motors, one on each tower are the lifting motors, the other two are the synchronizing motors)

Maximum starting torque—One motor . 1,550 lb. at 1-ft. radius
Full-load torque . . . . 738 lb. at 1-ft. radius
Maximum running torque . . . . . 1,750 lb. at 1-ft. radius

This maximum running torque will be reached in every operation of the bridge when the definite timing device for acceleration has thrown in full energy before the maximum torque speed of the motor has been passed. This will probably be true only when there is a heavy unbalanced load on the span or when the rail locks are iced in.

The machinery is designed to open or close the bridge, which has a 30-ft. lift, in 70 seconds. The relative speed at 1-ft. radius at motors, and speed at teeth on sheave rack, is about 125 to 1 (allowance being made for accelerating and retarding). Using A.R.E.A. specifications for friction for the train of gears between motor and sheave rack, the machinery has an efficiency of 82 per cent.

The maximum force exerted on rack tooth is,

$1{,}750 \times 125 \times 0.82 = 179{,}000$ lb. (total for two sheave racks).

The rack-tooth force of 179,000 lb. minus the load to overcome trunnion friction has to be transferred from the sheave to the ropes by the friction between the ropes and the sheave.

Total load on sheave trunnion boxes is

$2{,}016{,}000 + 150{,}000 = 2{,}166{,}000$ lb.

The amount of the rack-tooth force required to turn sheave is

$$\frac{2{,}166{,}000 \times 0.12 \times 12}{75} = 41{,}000 \text{ lb.}$$

The factor 0.12 is the specified running friction on the trunnion, 12 is the trunnion radius, and 75 is the sheave-rack radius.

The available net rack-tooth force that may be applied to overcome unbalanced load, bending of ropes, inertia, etc., transferred by friction from sheaves to ropes, is

$179{,}000 - 41{,}000 = 138{,}000$ lb.

The approximate coefficient of friction required is

$$\frac{138{,}000}{2{,}016{,}000} = 6.8 \text{ per cent}$$

With machinery well worked in and well lubricated, the motor will exert a much greater force on the rack teeth than these figures show, requiring a greater coefficient of friction.

Sampling and Soil Tests for Bay Bridge, San Francisco

Method of taking soil samples at the great depths to which the foundations of the San Francisco-Oakland Bridge foundations penetrate—Methods and results of sample tests—Consolidation tests and testing apparatus

By Daniel E. Moran
Moran & Proctor, Consulting Engineers, New York, N. Y.

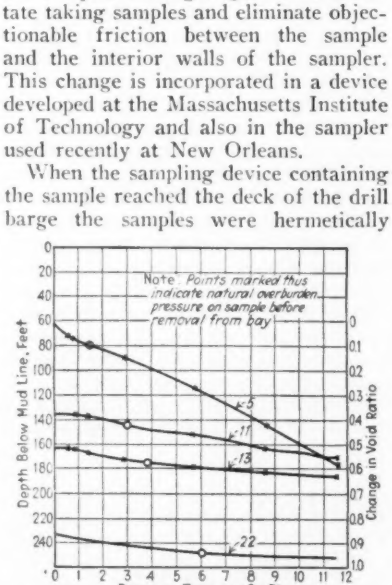
THE ENGINEERS charged with the design of the San Francisco-Oakland Bay Bridge decided at an early meeting upon a program of borings and soil tests for the purpose of determining the character of the material in the bed of San Francisco harbor. The object of this program was: (1) to acertain the most desirable location for the center line of the bridge; (2) to determine the best location for individual piers; and (3) to form a logical basis for the design of the piers. The program adopted was intended to determine the depth to and character of bedrock and the character of the overlying soil.

The board had access to borings made in 1930 and recorded in the Hoover-Young report of August, 1930. These were jet borings covering a wide area of the bay, made primarily to determine the depth to bedrock, although frequent drive samples of the overlying soil were taken. A contour map of the rock surface prepared from these borings showed that probably the most advantageous location for the piers of West Channel crossing lay between Rincon Hill in San Francisco and Yerba Buena Island.

Although it was anticipated that the piers and anchorages for the long suspension spans of the West Bay crossing would be carried to rock, it was considered highly desirable, in order to forecast the condition that might be encountered in sinking deep caissons to rock and to furnish a guide to contractors bidding on the work, to determine the general nature of the overlying soil. Wash-pipe borings were therefore used to obtain frequent dry samples. The materials indicated by these borings varied from a soft mud to strata of compact sand. In general, however, the materials encountered are not expected to present any great difficulty to sinking the caissons with the aid, where necessary, of cutting and lubricating jets. In order to determine definitely the character of the rock, rock cores were obtained with diamond drills. A number of small-area loading tests confirmed the evidence of the core samples that the rock would provide a reliable bearing surface for the heavy piers. As the plans progressed and the number and location of the piers were determined, new borings were made at the pier locations.

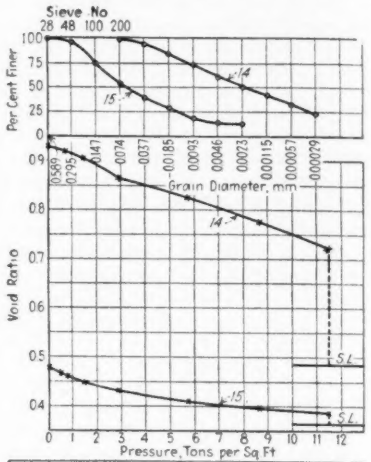
The problem in the East Bay crossing from Yerba Buena Island to Oakland was radically different. Wash-pipe borings indicated that the rock dropped off sharply east of the island to depths unattainable by practicable construction methods. It therefore became necessary to determine accurately the character of the overlying soil, so that the piers might be designed to reach a suitable stratum, and so that safe unit loads for each stratum might be determined. To obtain the information necessary for a rigorous analysis, the sampling device described in *Engineering News-Record*, June 23, 1932, p. 891, was developed. The samples obtained by this device seemed to be virtually undisturbed as to water content and natural structure. The writer believes, however, that a slight inward deflection of the sampler cutting edge would facilitate taking samples and eliminate objectionable friction between the sample and the interior walls of the sampler. This change is incorporated in a device developed at the Massachusetts Institute of Technology and also in the sampler used recently at New Orleans.

When the sampling device containing the sample reached the deck of the drill barge the samples were hermetically sealed without removal from the sampling tube. The tare weight of the container having been previously noted, the gross weight of the sample and container was recorded. When these weights were checked in the laboratory of the University of California, where the samples were shipped for testing, no loss of weight was observed over a period of several months. In general, it was found that the sample filled the container and was apparently a perfect natural sample, as might be expected from the care taken in securing the sample and the methods used, which practically precluded any change in water content and any disturbance of the natural structure. In some of the clay samples, however, a slight swelling of the sample was noticed when the top cap was removed, so that the soil projected beyond the end of the cylindrical walls. No entirely satisfactory explanation of this small increase in volume was found. The cause may be related to the change in external pressure effected by the removal of the sample from its deep bed.


Note: Points marked thus indicate natural overburden pressure on sample before removal from bay
Depth Below Mud Line, Feet
Change in Void Ratio
Pressure, Tons per Sq. Ft
5
11
13
22

Sample No.	Elevation	Description	Moisture Content	Void Ratio	Liquid Limit	Plastic Limit	Shrinkage Limit
5	-102′	Stiff Clay	63.7	1.700		38.3	28.6
11	-176′	Clay	43.5	1.160	83.4	25.0	15.1
13	-203′	Clayey Sand	29.1	0.775	26.2	28.4	21.0
22	-273′	Clay	17.4	0.464	33.5	15.8	14.0

Fig. 1—Clay and silt moisture content decreased with depth of soil below muck line.



Sample No.	Elevation	Description	Moisture Content	Void Ratio	Liquid Limit	Plastic Limit	Shrinkage Limit
14	-221′	Firm blue clay	34.8	0.931	55.5	27.7	18.2
15	-234′	Clayey Sand	18.0	0.480	21.8	18.3	13.6

Fig. 2—Clay and silt moisture content increased with fineness of grains composing the mass.

Testing samples

For a rational design of the piers it was considered necessary to determine the structural characteristics and the behavior under load of the soil to be loaded. It was also important to determine the character of the strata above the foundation level as affecting problems of excavation and construction. It was of general interest to note any relation that might exist between the degree of consolidation of the natural beds and their depths below water surface and mud line, and between the degree of consolidation and the grain size, and any other relations that might exist between the consolidation

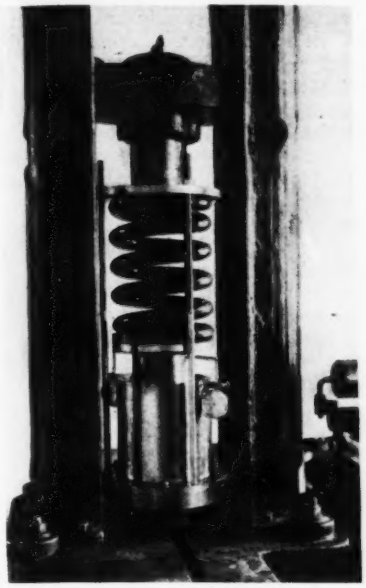


Fig. 3—Improved consolidations test apparatus in position in testing machine.

and other characteristics of the soil. Any such relationship, if established, might be of value in eliminating the necessity for an undue number of tedious consolidation tests.

To permit a comparison of core samples taken from the East Bay crossing, a series of routine tests was undertaken at the University of California, including the following:

1. The specific weight of the sample in its undisturbed condition was determined from measurements of weight and volume and by immersion in water.

2. The moisture content was determined by drying the sample to constant weight in an oven at 105 deg. C.

3. The specific gravity of the constituent grains was calculated from the observed values of moisture content and specific weight, assuming the soil to be completely saturated. Some of these values were later checked by direct determinations made by the pycnometer method in the laboratory of Moran & Proctor in New York City. The values obtained by the pycnometer ranged between 2.65 and 2.72 gm. per cu.cm., indicating that if a value of 2.68 be taken as constant, the calculated results would not be in error by more than about 1 per cent.

4. The sizes of the constituent grains were determined by sieve analysis and by the Bouyoucos hydrometer, separating grains down to 0.001 mm.

5. Atterberg's shrinkage limit was determined for undisturbed samples. Shrinkage limits of undisturbed remolded samples were determined in Moran & Proctor's laboratory. Determinations of Atterberg's plastic limit and lower liquid limit were made in both laboratories.

6. Compression tests to failure were conducted on 2x2-in. cubes and cylinders of undisturbed material without lateral restraint, and in directions parallel to and perpendicular to the bedding plane.

7. Compression tests were made on 4.87x9-in. cylinders of undisturbed material under lateral restraint in an attempt to evaluate the effect of lateral restraint on the compressive strength and deformation of the clays.

In addition to the tests specifically mentioned above, complete routine tests were made in the laboratory of Moran and Proctor on a number of samples. These tests confirmed in general the results of tests made at the University of California.

General observations of the routine tests mentioned above indicate that:

1. In beds of clays and silts otherwise similar in general characteristics the moisture content decreases with the depth below mud line, as might be expected since the deeper beds have been subjected to consolidation for a longer time and under higher superimposed loads (Fig. 1).

2. For clays and silts the moisture content of otherwise similar locations increased with the fineness of the individual grains composing the mass (Fig. 2).

No simple relation was discovered which would enable a forecast to be made of the probable consolidation of a given sample other than the evident relations that the higher the natural moisture content the lower the shrinkage limit, and the finer the constituent grains the greater the probability of a high consolidation under load.

The tests for shrinkage limits in the undisturbed and remolded states indicated in general a decrease in this value with remolding.

The routine tests were useful also in establishing the stratification of the materials through which the caissons will be sunk. The bed of the bay consists of a 30-ft. blanket of soft harbor silt or mud. Underlying this are clay, sand and sandy clay strata of varying stiffness. In general, these underlying deposits are of such a nature as probably to require extensive cutting and lubricating jetting in the sinking of the light-weight caissons proposed.

Consolidation tests

Having obtained the general information given by the tests enumerated above, it yet remained to predict the behavior of the natural clay deposits under the proposed pier loading. In general, bridge piers founded on granular material may settle as the result of one or more of the following causes:

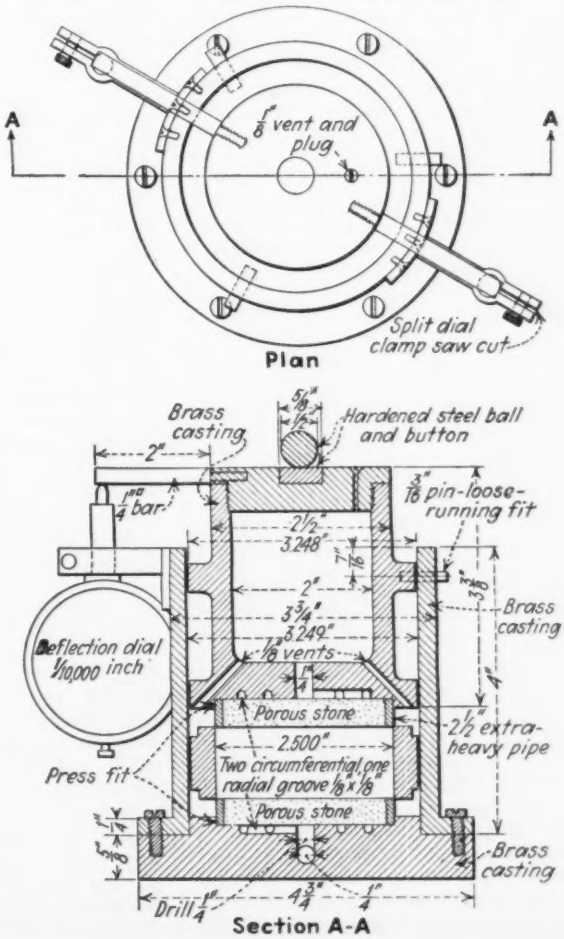
1. The displacement or removal of part of the supporting bed by erosion or scour.

2. The lateral displacement of the supporting bed due to insufficient lateral restraint.

3. The consolidation of the underlying material by: (*a*) elastic compression of the constituents of the bed; (*b*) crushing of the soil grains; or (*c*) displacement of water from the mass, permitting a corresponding consolidation.

Since (1) there is no appreciable scour or erosion in San Francisco Bay, (2) there will be sufficient surcharge to provide ample lateral restraint, and (3) the unit loads imposed on the granular material by the proposed piers are

Fig. 4—Mechanical details of improved apparatus for consolidation test of soils.



extremely small compared to the moduli of elasticity and crushing strength of the constituent solid matter, the principal source of settlement will be the consolidation of the underlying deposit, particularly the silt and clay strata, by the displacement of water. The study of the probable settlements, therefore, finally resolved itself into a study of the results of direct consolidation tests made on undisturbed and remolded samples from the clay deposits. Both undisturbed and remolded samples were used because it has been found that, in general, tests made on clay samples in which the original natural structure has been disturbed by pugging, working or remolding, giving lower values for resistance to consolidation than when the tests are made on undisturbed samples. It has also been noted that the shrinkage limit of an undisturbed sample is higher. Both of these changes in test behavior point to the fact that in many cases a bed of undisturbed clay will safely support a higher unit load than the same material after it has been disturbed.

The apparatus used in making the consolidation tests follows the general lines of the Terzaghi device, but was especially designed for this work by Moran & Proctor and is believed to be an improvement over devices previously used. As early as 1910 the author made consolidation tests on undisturbed samples of clay and other materials, using a thin-walled brass cylindrical tube both as the sampling device and as the container resisting lateral distortion during the consolidation tests. In this early apparatus two pistons were used, the cylinder being floating—that is, unsupported except by friction with the sample, so that no part of the applied load could be transmitted from the top piston to the cylinder and from the cylinder to the base. There was, however, the probability that some part of the load would pass from the upper portion of the sample to the cylinder wall by friction, and at a lower level be transferred again by friction to the lower portion of the sample. The probability of this error was increased by the fact that the length of the cylinder equaled the diameter. In the new apparatus the floating cylinder was retained, but the probability of error was reduced by making the height of the sample about one-third of the diameter.

In the early apparatus the top and bottom pistons were not guided, so that they occasionally tilted and jammed in the cylinder. The pistons were steel disks, thin porous pads or filter beds of sand being placed between the pistons and the sample. In the new apparatus the pistons consist of porous stones mounted in metallic rings. The motion of the pistons is guided so that jamming is prevented.

This apparatus keeps the sample surrounded with water during the test, so that there is no loss of water from the sample by evaporation. The effect of deep submergence may be imitated by applying pressure to the water surrounding the sample.

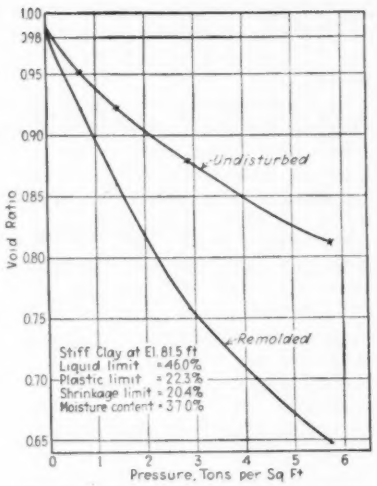


Fig. 5—Comparison of consolidation curves of natural and remolded soil.

When the load is applied to the sample by the usual type of compression machine, the load falls off with consolidation. This objection was overcome in the University of California laboratory by the use of a heavy spiral spring and side rods. Load was applied to the sample through the spring and was maintained by tightening the nuts on the side rods. As an elongation of the spring of 1 in. would cause a reduction of load of only 2,000 lb., the small elongation, due to the slow consolidation of the sample, caused a negligible reduction of load. The use of the spring permits of removing the apparatus temporarily from the testing machine without affecting the applied load. With a lever-arm testing machine, such as is commonly used in soil laboratories, constant load can be maintained on the sample without the use of the spring, but the consolidation apparatus cannot be removed from the testing machine.

Two essentially similar consolidation devices were constructed and used by the University of California in these tests. The larger device, designed to test samples 4.87 in. in diameter, is shown under load in the testing machine in Fig. 3. Fig. 4 shows details of the device developed for testing samples 2½ in. in diameter.

In conducting a consolidation test as soon as the sample is freed from its metal container, a smaller sample for the consolidation test is prepared, using a cutting ring exactly as a biscuit cutter is used in dough. The small sample is then forced by means of a close-fitting plunger from the cutting ring through the transfer ring into the testing ring. The top and bottom faces of the sample are then struck cleanly across the ends of the testing ring, insuring plane parallel surfaces. The testing ring and sample are then placed in the device and the load is applied. Consolidation is measured by two deflection dials.

The device is so arranged as to permit the application of a uniform hydraulic back-pressure. A few tests were made to determine the effect of such a pressure on the consolidation characteristics of the sample. As expected, the consolidation effect followed the difference between the pressure applied by load and the back-pressure exerted by external water. Supplementary to the tests made at the University of California, a series of consolidation tests was conducted in the laboratory of Moran & Proctor, where tests were made also on remolded or disturbed samples of material. On samples where the expectation is that timber piles will be used, the remolded or disturbed samples of clay showed a greater consolidation under load than the natural material. Fig. 5 illustrates this difference.

Pile tests

Information regarding the action of piles was obtained from a loading test made on a group of nine piles driven at the location of one of the East Bay piers and from short-time loading tests on a few piles up to their ultimate bearing capacity. The complete records of resistance to driving and of settlement under load of individual piles indicated:

1. That the ultimate bearing capacity was about one-fifth of the value given by the *Engineering News* formula.

2. That there was no relation between the resistance to driving and the resistance to loading.

3. That the piles developed about 400 to 500 lb. per sq.ft. of skin friction.

The information obtained from the tests was of great value to the engineers charged with the design of the piers. No attempt is made in this article to discuss the methods used in applying the results of the laboratory tests to estimates of probable settlement. The progress report of the special committee on earths and foundations of the American Society of Civil Engineers, May, 1933, discusses this subject fully.

The laboratory work was done principally at the University of California under the direction of Prof. Raymond E. Davis and R. W. Carlson. Additional tests were made at the laboratory of Moran & Proctor by William P. Kimball.

The engineering organization charged with the design and construction of the bridge comprises: Charles H. Purcell, chief engineer; Charles E. Andrew, bridge engineer; and Glenn B. Woodruff, designing engineer, San Francisco Bay Bridge Commission; Ralph Modjeski, H. J. Brunnier, Charles Derleth, Jr., Leon S. Moisseiff, Moran & Proctor, board of consulting engineers.

Ten Business Problems of Contracting

V—Coordinating Central and Field Offices

Central office establishes contracting policy, is responsible for securing and financing business, does purchasing and should plan construction, making field office responsible only for executing construction

By J. L. Harrison
Senior Highway Engineer, Bureau of Public Roads, Washington, D. C.

THE FACT that published discussions of contracting usually emphasize the importance of its construction aspects, to the all but complete exclusion of its many other aspects, appears to have created a widespread impression that most of the responsibility for profitable operation rests on those who handle the construction phases of this work. There is, of course, something to be said for this point of view. Otherwise it would have been abandoned long since. *On the other hand, this view will hardly bear close analysis,* for, of necessity, it relegates such matters as securing business, financing it, purchasing and planning to a position of inferiority which they by no means deserve. But because of the importance customarily assigned to construction and the responsibility so often placed on those in charge of it, the position it occupies deserves some discussion.

As a logical approach to this discussion, it may be remarked that whether it is large or small, the central office is the contractor's business office, and as such it handles the business side of contracting. Relatively speaking, the central office is a permanent organization. *As a rule, construction organizations are temporary*—i.e., *built up for a job and then disbanded.*

But of more significance in measuring the importance of the responsibility that various phases of contracting involve, it may be well to note that the transaction of any sort of business requires the establishment of policies. If an organization is so large that subordinates handle a good many of the details, circumstances constantly arise in which these policies must be interpreted, amplified or modified for the guidance of these subordinates. In the very nature of the case the central office is responsible for the establishment of policy and for all decisions that affect policy. The importance of the central office and the superior nature of the responsibility that it carries emanate from its relation to and its actions on policy.

Subject to established policy, the central office also is responsible for securing business, for financing it, for purchasing and, while this is not always done, should plan construction activities and give general oversight to the execution of all plans affecting construction. The field organizations execute these construction plans.

When contracting is viewed in this way, it becomes apparent that there are three distinct fields of activity in which the possibility of operating at a profit may be vitally affected. These are the general fields of policy, of business transactions and of construction.

Setting working policies

Practically every aspect of the individual contractor's affairs is affected by the policies under which he operates. These policies may be clearly set down —rather a rare thing in the business world—or specifically known only to the contractor himself. If kept to himself, they may be recognized as policies, but it often happens that they are so intangible that even the contractor himself seldom thinks of them as policies. Be this as it may, whether specific and well recognized or so nebulous that they are never consciously treated as such, every contractor has definite policies; and whether he realizes it or not, these policies affect all his operations.

Of necessity, policy is based on judgment. But in every matter in which judgment is a factor there is wide opportunity for inaccuracy and for positive error. It is not unnatural, then, that there is a good deal of unsound policy in contracting just as there is in other lines of business. But in so far as established policy is unsound, the situation created by this condition is particularly unfortunate because policy controls whatever acts, practices and procedures are based on it; therefore, if it is unsound, it tends to prevent the operations from being wholly successful.

The difficulties that contractors encounter here are hard to deal with for two reasons. In the first place the fact that policies are so seldom reduced to a concrete statement may be accepted as indicating that they are seldom brought frankly into the foreground for thorough discussion and analysis. Add to this quite general situation the fact that policy originates with the head of the organization and so cannot, as a rule, be openly questioned by subordinates without considerable risk of giving serious offense; it is not surprising, therefore, that though policy is vital, any errors in it are difficult to get at and even more difficult to correct.

In the second place the effect of unsound policies is likely to be so indirect and intangible or so delayed that it is difficult to compare policies with the results that are secured under them unless a very definite effort is made to do just this. Again the psychological problem involved is serious. The head of the organization is responsible for policies. The reasons actuating their adoption may be known to no one else. Therefore, even if a careful analysis indicates that certain of them are productive of unfortunate results, it still is not altogether expedient for subordinates to suggest changes.

On the other hand, because policy may be and indeed often is the cause of unprofitable operation — is even more often the cause of operation at less profit than could readily have been secured—there is no other aspect of contracting which deserves more constant thought or more careful study than the effect of the policies under which this work is handled. The matter of policy is so vital a factor in contracting—as it is in other busness undertakings—and so generally the real cause of unsuccessful operation, that the slightest sign of failure to secure expected results should cause a thorough re-examination of it. The trouble is more likely to lie here than anywhere else.

To some, this statement may seem to be a general indictment of management. True, it may be so interpreted, but this is not a strictly accurate interpretation. There is no line of business in which management is perfect. Management in contracting is neither better nor worse than it is in other fields. But it is never perfect. Nothing is perfect which depends on human judgment. In the formation of policy the better the judgment and the broader the study of the conditions to which it is to be applied the fewer errors will be made. So the statement that when things are going wrong in the contracting field, policy is more likely to be at the bottom of the trouble than anything else, though it emphasizes the fact that policy often is at fault, it should be accepted as more definitely stressing the fact that when an unsound policy is in force, the effect is serious. To a certain extent this is due to the very nature of policy. It governs so widely that the results can hardly be other than serious. But of even more importance than this, policy is a continuing thing. A job may be badly handled, but that is only one job. An order for materials may be errone-

ously placed, but after all it is only one order. The effect of errors of this sort can be localized, and they need not be allowed to recur. But policy is a continuing recurring thing which, while it is in force, affects all jobs and touches everything the organization does. For this reason even minor errors in policy may, and often do, cause more damage than major errors in other fields. For this reason, too, policy can hardly be given too much thought or its effect too much or too thorough study or the comments of subordinates on it too serious consideration.

Securing business

Besides its responsibility for establishing policy, the central office is responsible for securing business. It is, therefore, responsible for the price that will be received for whatever work is done.

The central office handles all financial transactions—that is, it takes care of general financing, pays all bills, except perhaps a few of minor importance, procures cash for payroll and other current needs and makes all collections. In so far as profit and loss are affected by a firm's financial transactions, the responsibility rests squarely on the central office.

All purchasing of any consequence is handled by the central office. Schedules of delivery are also made there. Whatever profit or loss attaches to materials transactions is, then, the result of central office activity. Purchasing evidently includes responsibility for the procurement of machinery, equipment, tools and supplies. Equipment will be discussed in a subsequent article. Here it will suffice to say that overlying policy governs a firm's investment in tools and equipment and that, as in the case of material purchases, this policy, whatever it may be, is executed by the central office. Job management has little to say about what equipment is purchased and, as a rule, not much more to say about what equipment is supplied to a specific job.

Planning construction

The central office should plan construction and supervise the execution of all such plans. This is not always done, though it usually is done by the better organized contractors. However, the fact that it is not always done leads in effect to two grades of responsibility for construction.

Where construction plans and schedules are prepared by the central office, they should cover all of the important aspects of construction. These are the equipment to be used, the order in which various phases of the work will be undertaken, the rate at which each phase of the work will be executed, the number of men to be employed, their grade and the wage rates to be paid, the privileges to be granted laborers, the hours to be worked per day, any special conditions affecting labor, and anything else which, as to the job in question, may be expected to influence the cost of construction. Evidently all these matters must be settled by someone. In practice it usually is desirable to settle them in the central office. This leaves for the superintendent of construction nothing but the perfection of an organization—a matter in which he is presumed to be an expert—and such direction of this organization as may be required in order to carry out the construction plan.

To put this matter in a little different way, engineers have found it desirable to prepare very exact plans of the thing they wish built. To these plans is added a detailed statement of their interpretation, of the materials to be used, of construction practices, etc., the better to describe the thing desired. Experience has indicated that this course protects the interests of both the owner and the contractor.

In executing the work through a field superintendent, the contractor faces a somewhat similar situation. The engineer has described, in detail, the thing he wishes to have. The contractor should prepare his plan for executing the work with the same care that the engineer has used in preparing the engineering plan. As a business man, his object is profit. But profit is not an accident. In any normal construction market the margin of profit is small, and unless every precaution is taken, this little margin will be lost. Logically, then, the prospect of securing a profit is improved if the means of securing it are given thorough study before construction starts, and if the results of this study are reduced to a specific plan of operation.

Incidentally, it may be remarked that the incentive a contractor has in planning construction with the care that the protection of profit requires is much greater than hired subordinates can be expected to have. Always there is a tendency among employees to follow the easiest course. Usually this is not the most profitable course. Also, it is worthy of remark as a fact of wide applicability that if employees had the ability to plan operations successfully as well as to execute them properly, they would not long remain in the employee class! There are, then, both positive and negative reasons which should encourage contractors more generally to consider that planning construction is both a normal and highly important function of the central office.

When contracting is handled in this way it is apparent that if the construction plan is faithfully carried out, all of the responsibility for profit or loss rests with the central office. This is as it should be. In contracting, as in other business activities, profit is much more likely to result from careful planning and the faithful execution of correct plans than it is to result from accident, adventure or haphazard effort. The contractor himself is presumably the strongest man in the organization. The central office is organized to handle the business aspects of construction. It should be organized to handle the preparation of plans for construction. In short, because of its relative strength as an organization and because it is under the personal direction of the head of the firm, the logic of the situation demands that the central office scrutinize every prospect of profit and that it accept responsibilty for every decision that can affect profit. This responsibility is accepted as a matter of course in securing business, in financing it and in all purchasing. It can also be accepted in planning construction, it is accepted by the strongest concerns and ought to be by all.

Where construction is planned in the central office the field superintendent is responsible only for the execution of the construction plan. If he fails to do this, while profit may of course be lost, the problem the central office faces is relatively simple. Was the trouble with the plan or with the superintendent? This is easy enough to determine, and action based on this determination is equally simple.

Delegating planning

But while the procedure outlined above is to be recommended—for in the last analysis it places the whole responsibility for profit (except as this may be lost through a failure properly to execute the construction plan) squarely on the central office where it belongs—it has been the observation of the writer that a great many contractors still delegate a large part of the planning of construction to their job superintendents. This is wrong in principle and often works badly in practice.

It is wrong in principle because, the objective being profit, it is quite undesirable to delegate the responsibility for handlng matters that may easily destroy profit, except to subordinates who have fully demonstrated their ability to assume such responsibility. Even then, all important decisions should be subject to review and approval before they are made effective. Management cannot reasonably expect to protect the profit which is its legitimate objective in all forms of business, unless it gives active attention to the details that affect profit. In planning construction these details include decisions on such vitally important matters as wage rates, the number of men to be used, the hours of work to be done each day, rates of production, privileges, etc. A great deal of money can be lost by careless decisions in regard to any of them. Actually a great deal is lost because decisions in these fields are left to superintendents who do not fully understand their importance and who are allowed to proceed without the assistance and the protection which an adequate review of their decisions should provide. The losses that result

are not surprising, for while superintendents are presumed to be expert in organizing working forces and in carrying out specific undertakings, they should not be presumed to be expert in planning construction. Nor should this statement be interpreted as implying that none is an expert planner, for the contrary is the case. Rather the thought is that planning and execution are two widely different fields. A few men are quite expert in both, but there are so many more who can execute a plan successfully than can both make a good construction plan and then execute it correctly that a contractor assumes a serious and in general a needless risk when he turns over both the planning of construction and the execution of the plan to a superintendent with whose experience and ability he is apt not to be thoroughly familiar.

This second method of operation—that is, the practice of delegating to the job superintendent the general responsibility for planning construction as well as responsibility for executing the construction plan as he works it out—places a good deal more of the responsibility for profitable operation on the job superintendent than he would carry under the first method. The general impression that in contracting profit is made or lost in the handling of the construction phases of the work appears to rest on a presumption that construction is normally handled in this way. A great deal of it is, and when this is the case the latitude given the superintendent usually is so wide that a few unfortunate decisions may easily ruin all prospect of profit. By the same token, when work done in this way is profitably executed, the credit due the superintendent is large as compared to the credit due him when he merely executes a carefully prepared construction plan. But even when operation is under the second plan, both the responsibility for failure and the credit for succes are likely to be less than many appear to assume. In any event general policy governs all operations. If this is good, a good superintendent has an excellent opportunity so to handle construction that a profit will be secured, but if the overlying policy is unsound, decisions over which he has no control may have ruined all prospect of profit even before he undertook the work. Much the same is true of the effect of actions taken in the purely business fields. These are beyond the scope of the superintendent's activities. Still they may have insured a profit or destroyed all prospect of it without his intervention and even without his knowledge. In short, even if the job superintendent is given wide latitude, it never is correct to assume that he alone is responsible for profitable or for unprofitable operation. Policy and actions taken in the business field are likely to have had more effect on the final result than the management of the construction phases of the work has had. This situation is clear enough if work is handled under the first system outlined above. It is not as clear when the superintendent is required to plan the work as well as to execute it, but the fact still remains that the responsibility both for determining policy and for the transaction of purely business affairs has more influence on profit than management of construction should have—a fact that it is quite as essential to remember when the responsibility for unfortunate results must be determined as when credit for satisfactory results is to be given.

Compensation Insurance Facts Important to Contractors

By R. Talbot
Research Engineer, Compensation Insurance Rating Board of New York, New York City

IN THESE days of few jobs, intense competition and low profits (if any) a full knowledge of compensation insurance, method of rating and proper payroll classification is of utmost importance to the contractor. Many a job has been lost by a contractor guessing his insurance costs when making up a bid. Many a potentially profitable job has ended in a loss because of careless or ignorant allocation of payrolls resulting in insurance costs that increased far beyond expectation. The whole subject of compensation insurance is a complex one, confusing at times even to insurance experts. But the basic principles of rate determination and premium costs are relatively simple and should be familiar to every contractor.

Basic compensation insurance premium rates are determined by the simple process of dividing losses by total payrolls. Individual contractors are rated according to accident losses, being charged the basic premium rates if their accident losses are average for the industry, but receiving a credit or penalty rating below or above basic rates if their accident experience is better or worse than average. Credit and debit ratings for individual contractors are constantly changing with their accident record. It is important for a contractor to know at all times just what his individual rating is. The premium rate charged a contractor on one job does not necessarily apply to the next job. He may be enjoying, for example, a 17 per cent credit rating. Through a series of accidents, possibly through no fault of his own, at the time of renewal this credit may be wiped out and even changed to a penalty rating by the accident experience on one job. If the contractor is not fully aware of this change in his rating, estimating his insurance costs on the next job may throw him into a serious loss. Likewise, a contractor's rating may be stepped up to a considerable credit by an unusually good accident record. He is penalizing himself on future bidding if he does not take into account his improved insurance rating.

Obviously, all classes of construction do not have the same degree of inherent accident risk. Skyscraper steel erection, for example, is far more hazardous than grading a county road. The types of construction are legion, and it would not only be impracticable but impossible to have a separate classification for each individual construction operation. This means that a great many types of work can only be classified by analogy to the most appropriate of the existing classifications, or to a classification that carries a rate comparable to the hazard assumed prevalent. Potential errors of judgment are not uncommon in the latter method of assignment.

The present "Compensation Insurance Basic Manual" contains more than 50 different construction classifications. Some of these classifications are all inclusive for certain work; others are very definitely limited to a specific operation. There are classifications that contain restrictive clauses prohibiting their use in combination with other classes, and still others have distinctly defined exclusions. The construction industry classifications at the present time carry rates ranging from approximately 3 per cent to 51 per cent of every $100 of payroll. It is, therefore, important that every contractor should know the scope or limits of each individual classification appearing on his insurance contract.

The question as to whether an amount of payroll is properly allocated to a rate of $10 or to one of $20 should be vital enough to make the average contractor "insurance conscious."

The importance to the contractor of proper compensation insurance payroll records cannot be over-estimated. If he knows the different types of work contemplated by the various classifications authorized for his risk, it is a simple matter for him to keep a payroll book on each specific contract that conforms to these assignments and to place the weekly payrolls for each employee according to his duties under the proper heading. However, when a contractor depends upon the insurance company's auditor to make the proper segregation from confusing records, possibly as late as six months after the job has been completed, he has no one to blame but himself if large amounts of payroll are charged to a classification carrying a $12 rate, for example, when a classifica-

tion rate of $4 would have applied to a large portion were it possible to separate it. The insurance company auditor has no choice in the matter. If unable to make the proper segregation, he is obliged to follow the payroll audit rule of the Compensation Manual, which is very specific on this point. "Payroll must not be divided on an estimated or percentage basis. If separate payroll records are not kept for operations which otherwise would be divided between two classifications, the entire amount of each payroll must be assigned to the classification carrying the highest rate."

The following simple hypothetical case will illustrate the importance of proper payroll segregation. The North Construction Co. and the South Construction Co. are awarded contracts for jobs that are nearly identical. The operations, when properly classified, fall into five separate construction classifications bearing rates of: class A, 4.26; class B, 7.55; class C, 8.02; class D, 10.13; and class E, 12.48. The North Construction Co. sets up payroll headings coinciding with each classification and places the weekly wage of each employee in the proper column according to his duties. The South Construction Co., on the other hand, for payroll record purposes, sets up two or three classes of operations which are easily identified, and assigns all other payroll under a miscellaneous heading. The work to be done under the two highest rated classifications, D and E, is of such a nature as to be readily distinguished. The employees engaged on work that falls under classifications A, B, and C are all assigned to the miscellaneous account with no identification as to their work except to designate them as mechanics, laborers, shovel operators, teamsters, etc. At the completion of the job the insurance company auditor finds the following premium chargeable to the North Construction Co.:

Classification	Payroll	Rate	Premium
A	$22,863	4.26	$973.95
B	12,093	7.55	913.02
C	15,732	8.02	1,261.71
D	7,980	10.13	808.38
E	11,349	12.48	1,416.36
Total Payroll	$70,017	Total Premium	$5,373.42

The audit made of the South Construction Co. records would line up as follows:

Classification	Payroll	Rate	Premium
A	Not separable, included with Class C	....	.....
B	Not separable, included with Class C	....	.....
C	$48,952	8.02	$3,925.75
D	7,350	10.13	744.56
E	11,013	12.48	1,374.42
Total Payroll	$67,315	Total Premium	$6,044.93

The auditor, not being able to pick out the payroll that under proper conditions would have been allocated to the two low rated classifications, was obliged to include such payroll under the highest rated classification in that group. The payroll for classes D and E was properly recorded. The summary of this hypothetical case is that the South Construction Co., which had a smaller total payroll, paid a premium of $671.51 more than the North Construction Co. Apply this same situation to a contract involving half a million dollars or more of payroll and the difference is astonishing.

The proper allocation of payrolls is also important for the classification of losses, which, ultimately, determine the basic rate for any particular classification of work. Assume that the South Construction Co. had claims for injuries to employees doing work coming within the scope of classifications A or B; but as the payroll could not be separated and the classifications will not appear in the audit, the losses sustained are reported against class C. The continual misallocation of losses to improper classifications eventually causes the basic rates for such classifications to rise out of proportion to the actual hazard. The ratio of payroll reported for each classification to the actual losses represents the statistical measure of hazards inherent in a given classification. When these figures are not reliable, a true measure of the hazard is not obtainable, and the resulting rate is out of all proportion to normal conditions .

In the construction industry, as in other industries, there exists the usual group that resorts to dishonest and unfair methods in connection with payroll accounts. The contractor who deliberately falsifies his records and conceals true payrolls is not only harming himself but is doing an injustice to the industry as a whole. Knowing that the full amount of his losses is bound to be reported, it would be expected that common sense would warn him against purposely lowering payrolls, as it is bound to have a detrimental effect on his individual experience rating. If the losses are properly reported and the payrolls purposely depressed, the resulting rate is bound to be greater than it would have been if correct payrolls had been made available to the insurance carrier and reported to the rate-making organization. Little by little this practice distorts the classification experience, and the basic rates are increased out of proportion to the actual hazards encountered in the performance of contemplated operations. Eventually the rates for comparatively non-hazardous classifications are going to rise to a point where they cease to be indicative of the inherent hazards and will carry rates on a par with classifications that contemplate more serious hazards.

The contractor who makes it his business to understand every phase of compensation insurance will not only be able to cut his insurance costs to the minimum but will also be considered a better risk from the insurance company's standpoint on account of the reliability of his records. Knowledge of insurance costs is just as essential to successful contracting as knowledge of the cost of any construction operation. The well-informed contractor can always keep one step ahead of an uninformed competitor.

Temperature Effect on River Flow Studied in Germany

By Samuel Shulits
Hydraulic Engineer, Cambridge, Mass.

IN A SERIES of articles in *Die Wasserwirtschaft* in 1931, Viktor Schauberger severely criticized modern hydraulic engineering methods, particularly those employed in river engineering. Mr. Schauberger claimed that the river regulation methods of today are fundamentally wrong due to neglecting the influence of what he calls the "temperature gradien," (*Temperaturgefaelle*), the change in temperature per unit length of the river in the direction of flow.

The Austrian federal department of hydraulic works subsequently asked R. Ehrenberger to investigate Schauberger's contentions in the federal hydraulic engineering laboratory, of which Mr. Ehrenberger is in charge, and also in the field. His findings are published in *Die Wasserwirtschaft*, March 25, 1933, p. 105, and April 5, p. 123, under the title of "Temperatur und Wasserbewegung" (Temperature and the Flow of Water).

Schauberger's theories are summarized in these articles and it is shown that some of his concepts contradict each other. It is further demonstrated that consideration of the "temperature gradient" would have the same effect practically as consideration of the temperature itself.

Experiments were conducted in the laboratory in a flume 32.8 ft. long and 1.64 ft. wide to determine the influence of the temperature of the water on its velocity. The water used in the different experiments varied from 50 to 68 deg. F. in temperature. No measurable influence of the temperature on the velocity could be found.

Measurements were then made on the Neuberg logging canal. Schauberger claimed to have observed there that in the morning at a temperature of 48 to 50 deg. F. it took a block of wood about 29 minutes to travel 2 km. (1.24 miles), while at noon at a temperature of 55.5 to 59 deg. it required about 40 minutes.

A section of this canal 5,143 ft. long was selected for the tests. Four sets of measurements were made: (1) Measurements of the temperature distribution in one and the same cross-section. (2) Simultaneous measurements of the temperature at both ends of the test stretch. (3) Float measurements. (4) Three complete current meter gagings at the downstream station. All these tests revealed no measurable influence of the temperature or the gradient on the velocity of flow in the canal.

PWA Planning Board Formulates Principles

Leaving specific project decisions to others, planning board concentrates on the development of principles for selecting and coordinating public works from the viewpoint of a national plan

WITHIN the past three months national planning of public works has been made an established part of the federal government's functions, as an element of the operations of the Federal Emergency Public Works Administration. By direction of the Administrator, Secretary Ickes, the National Planning Board was set up to develop the "comprehensive national plan" and to advise the Administrator, with a view to making sure that the $3,300,000,000 fund provided by the Act would be so utilized as to contribute most largely to the development of the country as a whole.

The board has not been required to consider or pass upon project applications, since the necessary speed of the emergency program did not permit of postponing the approval of projects until a comprehensive plan could be worked out. Instead it has concentrated on formulating principles and policies to serve as a guide in selecting public improvements from the viewpoint of a national plan. The work which it has begun and projected promises to mark a new departure in the public-works field.

Two distinct elements are included in the board's planning: (1) The immediate job, which consists of applying sound public development policy to the emergency operations of the PWA, and (2) the long-time job, which is to work out the fundamentals of a national plan and its practical realization. The latter is regarded as the principal job.

Three aspects of planning

By virtue of the character of its makeup, the board is equipped with unusual experience and breadth of view. Frederic A. Delano, chairman, represents the physical planning side, having been active for many years in the actual development of major city and regional plans. His work in connection with the Chicago plan and as head of the New York regional plan and the Washington Planning Commission familiarized him with the engineering approach to planning, including a recognition of land use factors, the importance of specific improvement works, and the like. Wesley C. Mitchell, professor of economics and head of the Bureau of Economic Research, is an authority on the economic elements of planning. As head of the Committee on Recent Social Trends, whose epoch-making report appeared two years ago, he has already weighed the economic and community movements involved in national growth. Prof. Charles E. Merriam, student of political science, is a specialist in matters of administrative planning and the relation of improvement projects to public finance and governmental method. Charles W. Eliot, secretary and executive officer of the board, is equipped by broad city-planning experience to bring together the elements of these several aspects.

Planning in the PWA program

As the emergency public-works program could not be delayed until a national plan might be developed, the function of the board with respect to this program has been to develop from time to time the results of special studies and statements of general policy and transmit them to the Administrator, Secretary Harold L. Ickes, and the Deputy Administrator, Col. H. M. Waite. Application of these policies to future allocations is expected to serve the intent of the Recovery Act that projects shall be fitted into a national plan.

Among the data considered by the board in this connection is the character of the projects embraced in the first installment of allocations by the Administrator. They were classified by types of work, whether construction or service (the latter being found to represent a considerable item), and the construction projects were analyzed and discussed with respect to their relation to public interests from various points of view. Details of the analysis and conclusions have not been made public, but future allocations are likely to show their influence.

The board's second function, that of laying the foundation for long-range planning over the whole extent of the country, is in the opinion of many governmental authorities the chief part of its mission. Four separate kinds of work have been outlined as essential:

(1) First of these is direct stimulation of local planning, including city, regional and areal planning. State planning is regarded as a coming possibility. A compilation of existing planning organizations showed that several hundred are now in action in the United States occupied with city, county or regional planning, and the board desires to further the work of all these bodies. A real planning is represented by the Tennessee Valley Authority and in incipient form by work done in the Columbia Basin area, as well as by work just being initiated in respect to Chesapeake Bay and its tributaries. The board believes that encouragement and stimulation of all these planning organizations, coupled with making public the tangible results accomplished for the public good through their work, is a first essential in preparing the elements on which to base more comprehensive planning.

(2) Coordinating the existing governmental agencies that deal with separate parts of a single problem is considered to be the second step in developing national planning. For example, public works and services related to transportation are in the hands of the Railway Coordinator, the War Department, the Bureau of Public Roads, and the several aeronautical bureaus. Already a conference has been arranged to bring together representatives of the first three, and aviation may soon be added, as an agency to discuss development plans in which the several means of transportation will be considered jointly rather than on individualistic competitive basis. It is intended to bring the work of the Land Use Planning Commission into coordination with other planning. Coordination of mapping and of study of natural resources is also to be sought as essential to providing data for comprehensive planning.

(3) Assembling the large amount of widely scattered information in the files of the government that relate to natural resources, economic factors, population and growth is contemplated as the third element.

(4) Finally, a research program is projected, along the lines of the work done by the Committee on Social Trends. Due interpretation of data in terms of public improvements is of course essential here.

Of these activities, all but the last mentioned are already in progress. Work on (1) is active, progress is being made on (2), and some work has been done on (3). Research is as yet in the rather distant future.

In the view of the officials of the board, the work it has begun is by its nature a long-continued undertaking and of lasting value. Its direct influence is on government policy and on the soundness of public expenditure; at the same time the public is benefited through more constructive public improvement development.

Under the present law this planning work is part of the Public Works Administration established by the Recovery Act and therefore will come to an end when the main organization is terminated. On the other hand the long-time nature of its major activity naturally implies reasonable permanence of the board's operations. Whether such permanence will come about is a matter dependent on future legislation.

The PWA Today: Is It a failure?

A Telegraphic Survey of State Conditions

Reports from the states show large number of projects in course of approval and many others in preparation—Rapid rate of lettings for next three months is indicated—No employment so far except on highways—Both local delays and loss of time through Washington routine check speed of progress

IS THE PUBLIC-WORKS campaign lagging? Since the PWA has produced few jobs to date, is it doomed to fail, as many people believe? What obstacles are holding it back?

These questions are leading issues today. In order to answer them by fact, *Engineering News-Record* this week made a telegraphic survey of the entire country to determine the status of the PWA campaign. In each state one or more well-informed engineers were asked to report briefly the condition and results of the PWA activities, the outlook, and the chief obstacles to progress and sources of delay in their state.

Encouraging Results

Returns at hand from nearly the full list of states present a broad and consistent picture. They answer the questions concerning the PWA campaign in highly reassuring and encouraging manner. Summarizing the reports, they show:

1. *Delay was real and serious*—The PWA campaign has lagged. In fact it virtually stagnated up to two or three weeks ago and in effect is just starting.

2. *Progress now is rapid*—Present PWA condition and activity throughout the country are excellent. The PWA staffs in the states are described as highly efficient. Organization was rapid when once started and remarkable progress has been achieved. Applications for project loans are being examined and approved quickly. Hundreds of projects have been sent to Washington headquarters approved by the state boards, and the rate of disposition is accelerating.

3. *Heavy employment likely within three months*—If the time taken to get under contract the few loans so far consummated is not greatly exceeded, recent and current approvals will result in a heavy rate of contract lettings during the next two to three months, and will start up a great volume of employment—probably half a million to a million men by the beginning of winter.

4. *Job prospects are increasing*—Back of the applications already filed is a much larger number of eligible and needed projects being prepared, and by far the most of these seem likely to reach the stage of formal application. The available data do not suffice for an estimate of their total, but it may go well beyond the unallocated remainder of the Recovery fund.

5. *Program has public's support*—Public interest in and support of the PWA program, which was of marked strength in June, suffered a bad slump—in some regions almost fatal—during the many weeks in July and August before the PWA field forces were organized, when prospective applicants were left in suspense, with no information on loan policies or procedure. The resulting apathy and inertia still survives in some states, but increasing interest is taken by local governments in getting all their work into project applications. Further, the opposition that until a few weeks ago held back many projects—on grounds of economy, reluctance to incur further expenditure, and lack of faith in the recovery plan—has died down under pressure of the re-employment need and the prospect of very heavy relief budgets for the winter.

6. *Stimulative efforts in progress point to success*—Active steps to speed the program are being taken in many parts of the country, including promotional work by regional advisers, educational measures by state authorities in cooperation with the state PWA officials, and legislative action to remove statutory disabilities of local governments that interfere with project applications. In some states approvals and loan allocations to one city are found to exert a stimulating effect on others, hastening their action in presenting applications.

7. *Progress can be further speeded*—Many obstacles and sources of delay remain. They are separately noted at the end of this article.

The reports from the states follow.

* * * *

Eastern States Affected by Early Delays

Reports from the eastern states with their large industrial populations emphasize the effect of early delay to the PWA program resulting from slowness to organize in Washington. In the absence of representatives, and lacking information on probable loan conditions and the data required for applications, the official and public indifference with respect to new expenditures found full opportunity to develop, and relatively few projects were got ready.

Intense activity, however, has developed since appointment and effective organization of the local PWA offices. Applications are handled efficiently and rapidly, and the number of incoming applications is increasing. A high rate of approvals in the next few weeks is assured.

City debt limits, excessive application detail, wage rate regulations, and incomplete preparation of applications are factors of delay. Loss of time in getting approvals is due both to applicants and to PWA procedure details. The obstacles are being progressively removed. Cooperation by state departments is a valuable factor.

Approvals Beginning in New England

Grants and loans totaling $660,000 for non-federal projects were approved by Sept. 23, but apparently no bond contracts had been executed. In Massachusetts alone applications reach $30 to $40 millions. The rate of approval by the state PWA offices is now rapid.

Delay in starting was due to opposition to public expenditure, public inertia, and statutory restrictions on municipal expenditures; failure of applicants to carry out instructions; hesitancy in authorizing money for preliminary engineering prior to assurance that the application would be approved. Early information, later corrected, to the effect that force account work would not be permitted, discouraged some municipalities. Regulations relative to hours and wages of labor have had a deterring effect.

Difficulties are being gradually overcome. PWA staffs are working with all possible speed. Time could be saved if preliminary cost estimates submitted by competent engineers were accepted with minimum checking. Immediate authorization by

municipalities of the preparation of contract plans and specifications would reduce the time required to put men to work.

State and municipal applications totaling nearly $8 millions have been approved in Massachusetts and will go to contract this fall and winter. Maine applications have been very slow, and some communities seem to expect loan approvals on preliminary estimates. Project applications in Vermont and New Hampshire reach $3½ millions, and three to four times as much is expected to be filed. Seven applications totaling $1,700,000 have been approved, the largest a $1,100,000 bridge near Dover, N. H.

Highway work is well started throughout New England; 10 to 20 per cent of the total allocations are under contract, but much work may not be let until spring.

New York Getting Into Action

After unusually long delay, PWA activity in New York is now rapid: Applications are coming in at increasing rate, and over 100 municipal projects are up for approval, though none has yet gone through. Needed public works of sound kind mount to great totals; in Western and Central New York to $50 millions, most of it well advanced so that it could start quickly, and in the metropolitan region probably several hundred millions even aside from the Midtown Tunnel and the Triborough Bridge at New York. Contracts for the Grand Island bridges and for the Midtown tunnel lining have just been let; no other PWA money is yet at work in the state except on highways. The latter are well under way as to main roads, but allotments for secondary roads are slow, which is bad because this work cannot continue during the winter.

Lack of knowledge of PWA conditions and terms caused serious delay during the summer. Debt limits, official apathy and reluctance to increase obligations and taxes are present factors. The great amount of detail demanded of applicants gives trouble, especially to towns that lack engineering staffs.

Wage rates cause difficulty in estimating costs. Some delay resulted from doubt whether force account work would be permitted.

New Jersey Plans on Grade Crossings

About 100 formal applications for loans have been made to the New Jersey board and 200 more have been made informally or have been discussed with the board's engineer. Many more are known to be under consideration. Action on a number of these is delayed for lack of completed plans or because the project has to be put to vote.

Detailed requirements set forth in Circular 2 have caused many communities to hesitate to make formal application, and some such applications have had to be nursed along by the board. However, communities that have made formal applications have not found the requirements too formidable. One town completed all the requirements in 48 hours.

A large amount of grade crossing elimination work will be available soon, in addition to that included under the highway fund, as the state has amended the grade crossing law to facilitate financing the railroads' part of the cost.

Serious Delays in Pennsylvania

Nearly $19 millions road money was allocated to Pennsylvania, but not a man has been put to work as yet because the Governor charges the government with excessive demands for plans and application data, while the government charges Mr. Pinchot with delay in preparing normal plans.

STATUS OF PWA PROJECTS, OCT. 1, 1933

Applications for non-federal loans and g'ts (Includes 525 carry-over from R.F.C.)		1,182
Applications approved		179
(Grant only, 84; loan and grant, 95)		
Loan contracts awaiting execution.	24	
Loan contracts not yet prepared	154	
Loan contracts executed *		5
Sylacauga, Ala., water	$ 100,000	
Tri-Borough Bridge, N. Y.	30,000,000	
Midtown Tunnel, New York	73,000,000	
New Castle, Wyo., water	20,000	
Jefferson Parish, La., water	8,000	

* Work has been begun on a number of projects for which contracts have not been executed, the municipalities supplying money for payrolls.

Non-federal projects also seem to be making little progress, possibly because the state PWA office is overloaded. Speed in pushing through applications from the smaller places would more quickly distribute employment where needed. Some well-informed people fear that no benefit of moment can be produced by the PWA work before April or May.

In western Pennsylvania progress is slow, due to various causes. Applications and plans are incomplete; nearly all have to be sent back for revision, especially as to financial information. Presentation of applications is held back by doubt of some cities whether they can afford to incur the additional obligation, by the fact that others have reached their statutory 2 per cent limit of borrowing power permissible without vote at a general election, and by reluctance to borrow at PWA interest rates. Contractors are hesitant in urging public-works projects until codes are clarified. Confusion between local wages and the PWA scale also obstructs progress.

Maryland and Delaware

Maryland on 17 applications has received four loans; time of action in Washington 2 to 3 weeks. Delaware on four applications has one loan; time of action 1 week. Delays in getting projects out are due to statutory restrictions, public apathy and reluctance to increase present debt, and incomplete engineering plans to some extent; also to difficulty with the PWA unskilled labor rate of 45c. Delay in getting loans through is due to detail review at Washington.

Future progress depends on legislative action to remove restrictions, in Delaware almost wholly, in Maryland about one-half. The Delaware legislature meets in special session Oct. 18, the Maryland legislature probably within 30 days.

Virginia in Good Shape

Of municipal projects in Virginia, 14 have received local approval ($11 millions) and five of these have already been approved by Washington. Progress has been delayed by (1) reluctance of citizens to undertake any public work at this time, and (2) a belief that the wage scales set by the Administration are too high.

PWA HIGHWAY WORK, OCT. 1, 1933

Highway projects approved (Includes 1,198, projects on state highway systems, 475 municipal, 243 secondary roads, 30 national park roads, 82 forest roads, 5 public-land roads.)	2,033
Amount of approved projects	$128,117,000
Construction contracts awarded, projects	1,165
Amount of awards (approx.)	70,000,000
Estimated employment on approved projects	164,000
Estimated employment on projects under contract	90,000

In order to overcome objections to public works projects, Governor Pollard charged the newly appointed State Planning Board with a program of publicity designed to inform the state as to the possibilities for recovery under the PWA. State departments are greatly aiding the PWA work.

Excellent progress has been made on the road-work program, and most of the allocation should be under contract shortly. Adjusting specifications to city road work, bridge designing and getting new projects ready took time.

West Virginia Does Its Part

Through consistent cooperation of a state public-works committee appointed by Governor Kump in July, the PWA board has received many applications and a number have been approved and forwarded to Washington. Some delay has resulted from the amount of information requested. There is said to be no political element in the PWA program in the state. Some confusion resulted in the past two weeks from a court decision that requires local taxes to go first to debt service. This difficulty is being overcome by more liberal rulings in Washington.

Of the funds allocated for roads about $2 millions is already under construction and the full amount should be under construction by the first of the year. As there is also considerable work by the Civilian Conservation Corps in the state, it is evident that West Virginia is doing its part.

* * *

Approvals Increasing in Central and Northern Region

A number of large projects in Ohio and Wisconsin have received loans and several are just starting construction, including Milwaukee sewage disposal plant and Cleveland water, sewer and incinerator jobs. The local PWA offices are working at high speed. Projects are being recommended to Washington at a rate that promises a great volume of active construction soon. Applications are increasing.

Among the delays in the early stages, incompleteness of plans and other application data is prominent. Various losses of time are charged to either excessive requirements or plain red tape in Washington. Full confidence of the people in the state and regional PWA organizations is everywhere a strongly helpful feature.

Ohio Approvals Center in Cleveland

Ohio's PWA work is marked by great activity in submission of applications and a number of important Washington approvals. The large cities account for the major part in money, but applications from small communities are numerous. Communities are ready to engage themselves on both general and income bonds. Delay by incomplete plans is now largely past. Some 200 projects have been filed with the Advisory Board, totaling in cost above $300 millions, of which probably 75 projects and $27 millions are in central and southern Ohio. The examining force is working at high speed. State approvals to end of September exceed $24 millions, and Washington approvals $16 millions.

Fourteen weeks after passage of the

Recovery Act, contracts have been awarded and work started on three of Cleveland's large projects, involving $4,400,000, by virtue of well prepared plans and applications. These projects were all part of the five-year program inaugurated in 1930, so that plans and the city's share of the cost were all ready. Work is being started with the city's money, pending execution of PWA contracts. On the other hand, the $8,900,000 sewage-treatment project and the $650,000 Metropolitan Park improvement project, which have been approved, cannot proceed until plans are completed, bonds prepared and the PWA contracts executed, which will require weeks of time.

Cleveland's $14,000,000 combined housing project has been tentatively approved pending the corporation raising $2,000,000 for the project. Euclid's home-building project, $2,800,000, has been approved and $1,000,000 allocated.

Indiana Board Working Efficiently

The Indiana board has 42 applications on file, totaling $9,400,000 to Sept. 30, and 24 projects, $7,200,000, passed the Indianapolis office. Board and engineering corps are working efficiently considering that an organization had to be set up and that the task was unprecedented. Washington is approving within two weeks, but no bond contracts have yet been executed. It will help to have the regional administrator or assistants trace projects through to Washington to final approval, award of loans and execution of loan contracts. Also, the regional administration might well waive minor technicalities. Where cities have been notified of approval, contractors are ready to proceed but loan contracts with the government are still lacking.

There is some holding back by cities, even on self-liquidating projects, for fear of tax increase. Local politics, incomplete information and minor prejudices have been other hampering factors.

Kiwanis Helps in Michigan

The situation in Michigan as to presentation of projects is much improved in the last two weeks. Of 73 projects now before the board many have already been examined and forwarded to Washington. Projects are well distributed throughout the state, the larger cities having the majority. Smaller cities are still obsessed by financial timidity.

A state Kiwanis meeting at Bay City appropriated funds for educational propaganda on benefits of the act and desirability of cleaning up the state, and advocated school construction where needed. The organization has made it a main objective of local club work throughout the state to disseminate knowledge of the financial opportunity offered by the Recovery Act and the necessity of abandoning dole dollars for actual wage dollars.

Wisconsin Is Active

No unusual delay can be charged in the Wisconsin PWA work, considering the magnitude of the plan, and no politics is apparent. Applications are being handled promptly by the state engineer. Frequent delays occur in Washington, due to legal questions. Delays in getting contracts across between government and borrower are reducing confidence that needful projects can be begun promptly. Chief cause of delays is borrowers' failure to procure proper engineering and legal advice.

Milwaukee's sewage-treatment loan of nearly two million went to contract quickly. Application was made July 31, the state engineer was appointed Aug. 12, allocation of funds was made Sept. 1, contract was received from Washington Sept. 23, and actual work is now under way.

Minnesota Has Approved $1 Million

Applications for 72 projects totaling $22 millions received to Sept. 30 by the state advisory board cover complete range of all construction work approved by the Act. Minneapolis as yet is not in because it does force-account work. Sixteen projects, amounting to $1 million have been approved. Washington has approved five, including paving, parks, and waterworks. All engineering plans have had to be returned to applicants because incomplete. Other delays are in Washington, where detail examinations appear to duplicate the work done in the state. Other losses of time occur; St. Paul paving projects were reported by Associated Press approved Sept. 9, but notice of approval was not received until Sept. 22.

Where the financial setup is good the state board is approving projects on word of city that they will vote the bonds. Cities are not holding back projects for economy reasons but there is much inertia. The state advisory board has the confidence of the people. However, confusion results when information given over radio by Washington officials does not conform to written instructions.

Illinois Outlook Improving

The PWA outlook in Illinois is improving. About 60 projects are before the advisory board, more than half of which have been forwarded to Washington. Six projects have received approval of Washington. As many more projects are known to be nearly ready for presentation. The bulk of the projects are from downstate, well dispersed. Financial inability to qualify rather than reluctance to incur obligation or expenditure is keeping back many applications. The smaller projects are in better shape and are coming in in increasing numbers.

The governor has included in his call for a special session of the legislature an amendment to the sewer rental law, curing a defect. Associations of commerce are responsible for keeping up enthusiasm. The tax muddle in Chicago and Cook County plus numerous defaults have made it extremely difficult to work out eligible collateral, but approval of certain projects, including some portion of the Sanitary District requests, seems imminent.

* * *

Activity in the Mid-Continent Area

Energetic activity by applicants and PWA organizations, growing public interest in the program and the actual beginning of work on two or three small projects are reported from Kansas and Iowa. Dragging of the program in Missouri is being fought by public education and preparation of an official schedule of eligible projects; institutional and school buildings especially need improvements. Debt-limit laws are a troublesome factor, and in Iowa the tieup of public funds in closed banks is restrictive.

Kansas Has Three Jobs Going

Progress on the public-works program in Kansas is generally satisfactory, but many meritorious projects are inactive. Heavy debt service on existing city bonds under the state law requiring serial bonds with 20 years maximum term, endangers approval of additional bond issues. A special session of the legislature this month may aid in financing needed public work.

Some projects are held back by a belief that extra costs due to the PWA wage scale more than offset the 30 per cent grant. Early delay resulted from the slump in public interest due to failure to effect state organization of the PWA promptly after passage of the Recovery Act.

Since completion of the state organization excellent progress is being made in examining applications. To date 63 applications total $3 millions, of which half have been passed upon and 8 have been approved at Washington, totaling $125,280. Three projects are under way.

Program Dragging in Missouri

Due to ultra-conservation and legal handicaps to bond projects, the PWA program is dragging in Missouri. Principal causes of delay are the constitutional limitation on city debt and the requirement of two-thirds vote to pass bonds. In July, the State Relief and Reconstruction Commission outlined possible public-works projects which included municipal and county projects with plans prepared and local funds in sight to the amount of $33,850,000, and projects recommended for further consideration $255,433,722. Applications to the state advisory board total only $10½ millions for municipal projects and half a million for a St. Louis housing project, the latter having received a tentative allotment from Washington.

A meeting of mayors, city attorneys, city engineers and other officials will be held this week at Jefferson City to assist in formulating a works program. Hugh Miller, state PWA engineer, has prepared a tentative program of $137 millions.

North Dakota's Early Winter

Projects amounting to $10 millions have been considered by the North Dakota PWA but only two ($550,000) have received approval so far. Some projects requiring bond issues were turned down by vote of the people but sufficient eligible projects can be financed to reduce employment greatly. Delay apparently is due to higher officials requiring too much minor detail. Plans and reports could be handled more efficiently by competent men in direct local supervision. Unless final authority on plans, reports and financial and legal requirements is entrusted to men close to the work there is no hope of the program being started in time to be of benefit this year, as the working season in the state closes too early.

Nebraska Much Delayed

During August and September, 63 PWA projects were filed in Nebraska, totaling $50 millions. The Omaha Utilities District has received the only two final approvals, $967,520 for a new gas holder and for extending water and gas mains. Minor projects, representing public buildings, water works and sewer disposal systems number 20 to 30.

The PWA work has been so much delayed that the entire program has been blocked. Delay is attributed to lack of

instructions, lack of organization,, and incomplete plans. These difficulties are being corrected. Large power and irrigation projects comprising $41,000,000 probably will receive study shortly.

Bank Trouble in Iowa

Iowa has about 100 applications in the state PWA office for nearly $7 millions. To date, 32 projects totaling $2,300,000 have received local board approval. Interest and activity are increasing rapidly due to the stimulus provided by projects recently approved.

Delays result mainly from difficulty in getting the complicated applications in proper form for submission to Washington. Many cities are held back from making applications by inability to finance due to public funds in closed banks, and by state laws limiting tax levies and requiring 60 per cent majority in bond elections. The state board organization is very able; there will be no delays due to it. In highways, over $3 million of the state's $10 million allotment is under contract, $1 million is scheduled for letting and $1½ million will be ready soon.

* * *

West Relies Mainly on Small Projects

In the less densely populated western, mountain and coast states, municipal projects of small size, widely distributed, are the principal reliance for construction reemployment—aside from federal work, of which there is a large total, both new and regular. Grand Coulee dam investigations, the Seminoe-Casper-Alcova power and irrigation project and warship construction on the coast are typical items of special federal allotments. The San Francisco-Oakland bridge and Los Angeles' Colorado River aqueduct antedate the PWA program.

A few small municipal projects have received PWA loans, but only one, in Colorado, is definitely reported to be under construction.

Highway work is active, as it is in the eastern states. Colorado is further increasing road-building employment by undertaking a highway program with its own money supplemented by a PWA grant recently approved.

Colorado Municipal Projects

One actual job is contributing the first employment on non-federal work in Colorado—a $20,000 water system in Morrison. Municipal projects for $5,600,000 have been approved or are near approval by the local PWA office, however. Several dozen small project applications now under study total about $7 millions.

Progress has been slow primarily because of delay in organizing the PWA. By June 30 a governor's committee had selected for recommendation 34 local projects, costing $2,800,000; work could have begun in 10 to 30 days. But the PWA state engineer and committee were not appointed till Aug. 12 and did not organize till Aug. 23. It gave first consideration to large irrigation and trans-mountain diversion projects, of which 22 costing $137 millions have been forwarded to the regional office for Washington consideration.

Colorado is adding to highway employment by a road program additional to its allotment from the $400 million road fund

PUBLIC-WORKS ADMINISTRATION ALLOTMENTS AND APPROVALS TO OCT. 1, 1933

AMOUNTS DISTRIBUTED BY STATES

(See foot of table for undistributed federal allotments)

State	Federal: Highways	Federal: Other Construction	Non-Federal: State and Municipal*	Non-Federal: Housing	Non-Federal: Private Corporations	Total
Alabama	$8,370,000	$2,107,000	$275,000	—	—	$10,752,000
Arizona	5,212,000	23,257,000	—	—	—	28,469,000
Arkansas	6,748,000	218,000	60,000	—	—	7,026,000
California	15,607,000	9,972,000	11,700,000	—	—	37,279,000
Colorado	6,875,000	209,000	10,020,000	—	—	17,104,000
Connecticut	2,866,000	315,000	336,000	—	—	3,517,000
Delaware	1,819,000	54,000	51,000	—	—	1,924,000
Florida	5,232,000	1,010,000	136,000	—	$1,000,000	7,378,000
Georgia	10,091,000	8,559,000	722,000	—	—	19,392,000
Idaho	4,486,000	4,576,000	15,000	—	—	9,077,000
Illinois	17,571,000	381,000	4,156,000	—	—	22,108,000
Indiana	10,038,000	145,000	409,000	$4,460,000	—	15,052,000
Iowa	10,056,000	401,000	3,497,000	—	—	13,954,000
Kansas	10,090,000	2,296,000	95,000	40,000	—	12,521,000
Kentucky	7,517,000	2,992,000	1,017,000	—	—	11,526,000
Louisiana	5,829,000	2,484,000	—	—	—	8,313,000
Maine	3,370,000	594,000	—	—	—	3,964,000
Massachusetts	6,597,000	5,299,000	130,000	3,500,000	—	15,526,000
Michigan	12,736,000	875,000	1,065,000	—	—	14,676,000
Minnesota	10,657,000	104,000	470,000	—	—	11,231,000
Mississippi	6,979,000	—	—	—	—	6,979,000
Missouri	12,180,000	232,000	421,000	500,000	—	13,333,000
Montana	7,440,000	3,547,000	45,000	—	—	11,032,000
Nebraska	7,829,000	80,000	2,575,000	—	—	10,484,000
Nevada	4,546,000	22,792,000	—	—	—	27,338,000
New Hampshire	1,910,000	100,000	810,000	—	—	2,820,000
New Jersey	6,346,000	1,750,000	18,897,000	—	—	26,993,000
New Mexico	5,793,000	1,418,000	—	—	—	7,211,000
New York	22,330,000	15,015,000	62,950,000	13,384,000	—	113,679,000
North Carolina	9,522,000	2,607,000	—	168,000	—	12,297,000
North Dakota	5,804,000	70,000	589,000	—	—	6,463,000
Ohio	15,485,000	2,843,000	15,123,000	13,000,000	—	46,451,000
Oklahoma	9,217,000	4,485,000	617,000	—	—	14,319,000
Oregon	6,107,000	26,401,000	1,500,000	—	17,000	34,025,000
Pennsylvania	18,891,000	2,252,000	—	2,135,000	—	23,278,000
Rhode Island	1,999,000	50,000	200,000	—	—	2,249,000
South Carolina	5,459,000	117,000	—	—	—	5,576,000
South Dakota	6,012,000	—	97,000	—	—	6,109,000
Tennessee	8,493,000	170,000	—	—	—	8,663,000
Texas	24,244,000	7,552,000	—	—	—	31,796,000
Utah	4,195,000	3,977,000	166,000	—	—	8,338,000
Vermont	1,868,000	1,920,000	5,000	—	—	3,793,000
Virginia	7,417,000	7,863,000	229,000	—	—	15,519,000
Washington	6,116,000	4,232,000	63,019,000	—	—	73,367,000
West Virginia	4,474,000	53,000	—	—	—	4,527,000
Wisconsin	9,725,000	—	4,845,000	—	—	14,570,000
Wyoming	4,501,000	23,509,000	155,000	—	—	28,165,000
Dist. of Columbia	1,919,000	3,418,000	—	—	—	5,337,000
Territories (Alaska, Canal Zone, Hawaii, etc.)	1,871,000	14,496,000	—	45,000	—	16,412,000
Totals	$394,004,000	$218,747,000	$207,190,000	$37,232,000	$1,017,000	$858,190,000

FEDERAL ALLOCATIONS NOT DISTRIBUTED BY STATES

(Not Included Above)

Farm Credit Administration	$100,000,000	Quartermaster Corps	1,160,000
Tennessee Valley Authority	50,000,000	Coast Guard	25,606,000
Naval Construction	238,000,000	Navy Department (Shore Stations)	3,325,000
Administration, PWA and NRA	1,730,000	Navy Department (Storm Damage)	857,000
Civilian Conservation Corps	71,037,000	Lower Mississippi Flood Control	43,987,000
Great Smoky National Park	1,550,000	Upper Mississippi Waterway	33,550,000
Subsistance Homesteads	25,000,000	Missouri River Waterway	14,153,000
Federal Power Commission	400,000	Other Rivers & Harbors	70,000,000
Re-Employment Service	500,000	War Department (Housing)	1,136,000
Department of Agriculture (Misc.)	28,514,000	Weather Bureau (Construction)	150,000
Forest, Park & Public-Land Roads	50,000,000	Biological Survey (Construction)	972,000
Coast & Geodetic Survey	2,600,000	General Land Office (Surveys)	1,000,000
Geological Survey	3,700,000	Increased cost of federal building	1,526,000
Lighthouses	5,225,000	Insular Affairs	1,500,000
Department of Commerce (Misc.)	873,000	Veterans Administration	515,000
Department of Interior (Misc.)	5,254,000		
Department of Justice (Prisons)	851,000	Total, not distributed by States	$794,073,000
Department of Labor (Immigration)	1,344,000	Total, distributed by States	858,190,000
Department of State (U. S.-Mex. Boundary Commission)	1,528,000		
Miscellaneous Federal Work	530,000		
Ordnance Department	6,000,000	Grand Total	$1,652,263,000

* In order to make direct grants to municipalities comparable as to amount of work created by combined loans and grants an amount approximating a 70 per cent loan has been added to the grants in compiling this table.

Except for minor amounts or amounts not definitely allocated, the allotments for army housing, land reclamation, post offices, etc. have been distributed to the several states.

of the Recovery Act, and for this purpose has requested and received a PWA grant, to be supplemented by state money.

One Loan in Wyoming

To date one municipal project loan in Wyoming has been authorized by the PWA, a $20,000 waterworks job. Applications and preliminary project inquiries number 75, totaling $90 millions; five approval recommendations to Washington total $1½ millions while another large amount is likely to have early action. About half of the projects are irrigation. The state PWA office is acting promptly and rapidly, but has had to call on applicants for additional data in most cases.

Federal work for which the PWA has allotted money amounts to $32 millions. Aside from highway construction, virtually no money has been spent to date.

The contribution of the public-works program to correction of unemployment in Wyoming will be comparatively small this year.

New Laws in Utah

Utah PWA work is proceeding with dispatch and energy. Delays are due mainly to slowness of municipalities in making out applications in the required form. No political influence is apparent, nor are cities reluctant to apply for loans.

Applications either filed or reasonably in prospect in Utah represent a total of nearly $40 millions, over half of which is irrigation. The state PWA office has received 60 applications totaling $13 millions, and has recommended to Washington 20 totaling $7 millions, about half of which is buildings and the remainder water, street and miscellaneous projects.

Most of the municipal project approvals will not be able to go ahead, however, until the state supreme court hands down its pending decision on two enabling laws passed by the legislature in special session last summer: one empowering municipalities to issue revenue bonds without referendum and independent of all existing limitations, the other empowering them to contract with the government for loans.

Educational Drive in Idaho

The Idaho PWA office has approved 22 projects, $1,200,000, and of these one for $13,000 has already been approved by Washington. Pending applications amount to only $700,000, but the total available and needed work in the state is variously estimated at $20 to $50 millions.

Presentation of applications is delayed by public and official lack of understanding of the scope and purpose of the Recovery Act, while action is delayed by applicants' failure to offer complete engineering and financial data. Within the past week organized educational efforts were started through public and group addresses. Meetings in all sections are planned. On Sept. 28 Gov. Ross and the state PWA board met at Boise with 200 representatives of southwestern Idaho projects.

Federal Work in Washington

By virtue of the PWA's $63 million conditional allocation for Grand Coulee dam, 250 men are at work with state funds on plans, surveys and foundation exploration. The emergency highway program (35 per cent of the $6 million allocation is under contract) has put 1,300 men to work on 23 sections. Other federal projects have already employed 1,200 men.

Of the $50 millions of non-federal projects submitted to the PWA board no project is yet under construction; only $18,000 has been approved. Delays are due mainly to unpreparedness as to plans, legal and other application data. Loss of time has also resulted from delayed application and agreement forms and some from local politics.

California Pessimistic

Except for highway work, now rapidly going to contract, California has no PWA construction as yet. Progress is slow and there is a growing belief that the program has come to a standstill. Yet the available projects form a large total; the state's list compiled in July included some 600 projects totaling $250 millions.

Delays are numerous. Only recently has the local PWA office received authority to employ the technical help necessary for reviewing the project applications, especially the smaller ones with their usually inadequate presentations. Minor irregularities in applications are given too much weight. Now that the state office is active, financing is the greatest element of delay to local projects. Many communities wait to get an indication of approval before they take steps to hold a bond election. There appear to be other delays also; tentative approval of the large grant for Sacramento Silver Creek project is reported to have restrictions that will require much more time before work can start. Finally, political influence weighs heavily on state PWA work.

* * *

Marked Activity in Some Parts of Southwest

All through the Southwest, real progress of the PWA program is only just starting. Two or three approvals have gone through Washington, and construction on them may start soon, but outside of highway work the PWA has made no jobs up to now. Much employment may come soon, however, as a great total of work is waiting for action; pending applications exceed $100 millions.

The outstanding picture of enterprise and initiative is that of Texas, where the local PWA office is swamped with applications and has had to call for additional personnel, but despite a very late start is now passing on projects at rapid pace. Bond and debt limits throttle the proposal of projects in Arizona and Oklahoma, less prosperous than Texas.

Imperfect applications delay progress in the Southwest as elsewhere.

Oklahoma Letting First Contract

The PWA program in Oklahoma has been much delayed and is just starting. Sixty applications to date total about $2 millions, and a few have been approved, the largest an Oklahoma city school, $132,000, for which bids are now being asked. Some small water and school district grants averaging ten thousand each are expected daily. The government has not yet taken bonds on any project. About $600,000 of highway contracts is being let per week.

Progress is checked by the constitutional limit on indebtedness, the fact that revenue bonds cannot be issued, defeat of bond issues submitted to voters, high tax rates and poor business.

Texas Office Swamped

As of Sept. 23 the Texas PWA ha received 351 applications totaling $77 mil lions and this swamped the office. Thoug the organization began to function prop erly only on Sept. 10 and until last wee was undermanned, it has passed nine ap plications ($3 millions); by Sept. 30 i will have passed 15 more ($5 millions) and thereafter probably 15 to 25 eac week, if additional help is obtained t maintain this schedule. Two thousand ad ditional applications originally filed with th State Rehabilitation and Relief Commis sion have not yet been considered.

Over fifty per cent of applications received to date do not have sufficient supporting data, and this is the chief source of delay, but is being overcome by rulings and advice. Washington's cooperation and the caliber of the state and regional PWA officials assure progress and absence of politics.

Arizona Needs Irrigation

Arizona has received loans for Prescott water supply ($50,000) and for a conservation district ($1,350,000), but has let no contracts yet. The PWA board, which received working instructions Aug. 17, has 23 project applications totaling $29,600,000, and has approved six of these, for $6 millions. Few applications are complete in plans and financial data; as to the others, the mass of detail required by the PWA regulations will take 2 to 6 months to prepare.

There are few municipal projects, as cities are at legal bond limits and have no security to offer. Most projects are for irrigation, and if the announced policy of not approving projects that will bring in new land is maintained Arizona cannot qualify for more than $6 million aside from $5 million flood-control projects that have been forwarded direct to Washington for initial action.

* * *

Southeast and South Helped by Winter Road Work

Encouraging progress is reported from most states in the Southeast and South. Financial conditions interfere in some regions, as in North Carolina, where federal construction and lease is to be tried, as well as in Georgia, Tennessee and Mississippi.

Due to the possibility of carrying on most highway work straight through the winter in these states, road employment is a more important factor than in northern areas. The road programs are therefore being pushed along systematically and effectively, with the prospect that by the end of the year most of the territory will have under contract half or more of its total allocation.

In the Carolinas

North Carolina has about 600 eligible projects (roughly 125 waterworks, 100 sewerage, 300 schools, and refuse disposal, drainage, parks), but financial difficulties and bond limits make it impossible for many communities to finance their 70 per cent, and some are therefore asking the government to build the projects and lease them to the community.

At the end of September 21 applications involving about $2,000,000 had been passed by the state advisory board, and more than 100 others are in preparation. Mass meet-

ings of local officials under the leadership of the state board are speeding up work.

Highway contracts for $800,000 are under way at present, and twice as much more will be let in a few weeks. At least 40 per cent of the state's road allotment of about $10,000,000 can be under way before the end of the year, and much of it can go on right through the winter.

South Carolina has sent to Washington six applications totaling $1,700,000 and nearly as much will go forward shortly. Financial difficulties are not a factor, but procrastination and incomplete applications cause delays.

Highway work is making good progress, and 35 per cent will be under way by November, and more than half by January. Delays have affected only city highway work.

No Delay in Florida

The Florida PWA board has recommended to Washington to date 9 projects involving a total estimated cost of $11,656,787. No unreasonable delay, either locally or in Washington, is reported.

Mississippi Plans Buildings

The public works program, much delayed in Mississippi so far, is now developing rapidly, both in applications received and in projects being prepared. Schools and court houses are in the majority.

Until the State PWA board was organized, cities and counties did nothing, as they lacked information on procedure and requirements. After the state engineer was appointed it took time to make plans and estimates. Small towns, which do not have their own engineers, are in general too poor to pay for preliminary engineering except on a contingency basis.

Satisfactory Progress in Arkansas

Considering the magnitude of the public-works program, progress in Arkansas is believed reasonably satisfactory. Organizing for a program new in character required time, and much educational work was necessary in view of lack of knowledge of applicants' procedure and PWA requirements. By now this has been measurably accomplished.

Louisiana Slow

PWA progress in Louisiana is disappointing. Local governments have made few loan applications, though these should increase rapidly following the board's just-completed educational campaign. Chief source of delay has been lack of proper information before the local PWA was organized. Small towns have no money to engage engineers, and officials hesitate to obligate themselves for isolated road projects in towns and parishes. The state PWA board has sent out inquiries to cities and parishes for a list of projects on which they intend to ask loans. Some estimates of the probable total reach $200 millions.

Bond Restrictions Bother Tennessee

State limitations on the indebtedness have slowed up the program in Tennessee as in North Carolina, and take all counties out of the picture. Financial difficulties keep Chattanooga and Knoxville, two of the largest cities, from issuing more bonds now. The state board has endeavored unsuccessfully to get the governor to call a special session of the legislature to liberalize municipal charters. Two-thirds to three-quarters of the public-works program depends on such action. Waterworks and sewerage projects are not included in the limitation.

Six projects, $1,250,000, have been sent to Washington and some twenty totaling $3 millions will be passed in a few days. Nashville will vote this week on issuing $4,000,000 improvement bonds. Much highway work is under construction and two-thirds of the state's $8½ million allotment will be under contract by January.

Bond Limits Also Hamper Georgia

Georgia's highway program, delayed by political conflicts, is now proceeding under high pressure. Contracts for $2 millions will be let by November and $5 millions or 50 per cent by the end of the year.

Outside of roads, 16 projects, $11,500,000, have been forwarded to Washington for approval, and 70 applications are pending, with total nearly $70 millions. About 20 applications are coming in per week. Only general obligation bonds or equivalent are passed, as the legality of revenue bonds and leases is undetermined. Attorneys are now trying to work out the debt limitation problem.

There is a good deal of holding back by communities that have always gone on the pay-as-you-go basis. Extensive local improvements are needed, notably sewerage works for Atlanta, but local sentiment is strongly against, more indebtedness.

Fast Work in Alabama

More than $15,000,000 in applications for various works, including waterworks, sewerage, canals, levees, drainage, auditoriums, public buildings and a variety of lesser projects, have been passed on by the state PWA organization. No serious difficulty has been experienced by local government units in taking care of their part of the financing. Some are close to their bond limits, but thus far no applications have had to be turned down on that account. Numerous large projects are in sight. All PWA activities are based on carrying construction through the winter.

Highway work had to get going from a standing start as, due to bad state finances, few surveys and plans were ready. Yet $1½ million of contracts have already been let and lettings of $1 to $2 millions will be held every two weeks, putting the entire allotment under contract this year.

* * * *

Summary of Causes of Delay

These individual state reports supply pointed information concerning the obstacles that stand in the way of the campaign or slow up its progress.

Obstacles, or causes that keep projects from being brought out, include (1) the public-economy attitude, or fear of further expenditure; (2) public and official inertia, largely due to ignorance of the Recovery Act and the PWA campaign; (3) debt, bond and tax limitations, whether constitutional or statutory; (4) Washington rulings against force-account construction of PWA projects; (5) in a few instances, local politics.

The first two of these are being overcome, though further educational work is necessary. The third (debt and tax limitations) is clearly the most serious and widespread difficulty.

Delays to applications include (6) incomplete preparation of plans or other application data (a very general condition), (7) reluctance or financial inability of town governments to employ engineers to plan and prepare their projects, (8) wage rate difficulties, (9) overloaded condition of the state PWA office because of late organization and piling up of work, (10) rechecking engineers' estimates to needless extent, (11) necessity of revising applications prepared on old Form 1, and (12) the complexity of Circular 2.

Some of these sources of delay are no longer important, others invite corrective action. Specifically, it appears that Circular 2 should be simplified; that either the state or the PWA authorities should provide a means by which small and poor communities can get adequate engineering help on other than a contingent-fee basis; and that the PWA wage-rate ruling should be rescinded and fitted to workable prevailing-rate conditions.

As to the greatest source of delay, incomplete applications, the cure lies with the engineers, lawyers and financial advisers of the local authorities.

Delays in approval and contract-letting, so far as the limited experience to date brought them to notice sufficient for inclusion in our reports, include (13) red tape, legal technicalities and other losses of time at Washington, (14) Washington rechecking of engineering details after the state PWA check, and (15) failure of applicants to go ahead with contract plans while waiting for PWA action on their application.

More decentralization is urged by engineers of standing as one cure.

As to legal red tape, the total time from application to men on the job is unbelievably long considering the national emergency. A semi-official estimate places the average time for going through the required steps from receipt of application to loan and bond contract, etc., at 3 to 4 months, only one-fourth of which is required for approval of the project and authorization of the loan, while three-fourths is consumed in the lawyers' routine of actual sale and approval of bonds to the PWA.

Engineering News-Record

EDITOR—F. E. Schmitt. EDITORIAL STAFF—V. T. Boughton, W. G. Bowman, F. W. Herring, C. S. Hill, H. W. Richardson, W. W. De Berard, N. A. Bowers, J. I. Ballard.

Editorial and Publishing Offices at 330 West 42d St., New York; 520 North Michigan Ave., Chicago; 883 Mission St., San Francisco; Aldwych House, London, England.

Subscription price $5 per year in the United States; foreign rates on application.

Copyright 1933 by McGraw-Hill Publishing Co., Inc.

October 5, 1933 Volume 111 No. 14

If Engineers Are At Fault—

FROM THE survey of the present status of the PWA works program presented on another page it develops that incompleteness of applications is the largest single source of current delays in the progress of the campaign. Hardly a state report but emphasizes this condition as aggravating or serious, and it is clear from the detailed statements of the survey that unless the resulting delays are eliminated the re-employment campaign is sure to languish. We do not believe that engineering shortcomings are chiefly at fault, for the requirements as to applications, detailed under the PWA's famous Circular 2, are burdensome more especially in the legal and financial items. But there is definite evidence that incomplete or defective engineering plans are part of the trouble, especially in the case of smaller towns, many of which probably had not employed engineers at all. So far as engineers are at fault in this situation, only one thing is to be said: that immediate correction of the fault is a professional and civic obligation. Poor engineering can at no time be condoned, but in the present emergency negligent or faulty PWA project plans are nothing short of malpractice.

Are Bidders Ready?

FREQUENT biddings for public works of a new order face contractors in the next few months. Are contractors ready to bid? With thousands of contractors long idle and looking eagerly for any sort of job, the question seems absurd, but this very idleness warrants the question. In the disintegrating experience of the depression, managing organizations have gone to pieces, equipment has grown obsolete, and invention and business alertness have been dulled far more than may be generally realized. This is weak armament with which to attack present-day construction tasks. The conditions of the moment are radically new, and no contractor should overlook or misappraise the fact. Bidding is confronted with an artificially imposed order of wages, hours of labor, choice of workmen and methods of working. Prices are uncertain and currency values are possible of change. Yet the work must be built with high efficiency and of high quality under federal supervision, and at maximum speed—not only to satisfy the emergency's demand most fully but also to hold down costs by eliminating all loss of time. Such other differences from the normal conditions and conduct of contract construction have to be met by new thinking and planning. The task is not a simple one, especially since confusion exists among the awarding authorities no less than among those who will make bids. More than ever before contractors now have to determine for themselves whether they are prepared with a knowledge of requirements and the tools of business to bid wisely. Self-interest as well as the obligation of furthering the PWA campaign dictates careful preparation for the coming demands.

Special Cements

THE DECISION to use a special high-silica cement for the south pier of the Golden Gate Bridge comes with a suddenness that is not usually associated with such important engineering developments. If less high authority than is credited with sponsoring the use of this special cement for sea-water exposure had made the decision, it could easily be ranked as ill-considered. For modern high-silica cements have little more than laboratory tests to recommend them. Service claims are based partly on European experience and partly on the excellent records of the old puzzolanic cements, which were of somewhat similar characteristics. The new high-silica cement is a portland cement with which a puzzolana material is interground which, in contrast to the usual admixture, is chemically active. The claim is made that the silica and the free lime in the cement combine to form a colloidal silicate, which by filling the pores contributes to impermeability, strength and elasticity, all of which are desirable characteristics for a concrete to be exposed to sea water. Recent years have seen engineers divide into two schools of thought on the matter of cement, one adhering firmly to the single standard that has prevailed for two decades, the other inclining toward special cements for special purposes. There has been an unmistakable strengthening of the special-cement group ranks in the last three or four years. The decision to use a high-silica cement at Golden Gate is further evidence of the trend.

Ignorance Is Costly

IGNORANCE of the laws and operation of compensation insurance is penalizing many a contractor, either in actual cash loss or by forcing him to bid at a disadvantage because of unwarranted insurance costs. Compensation insurance operations are complex and confusing. Yet, as is pointed out in this issue, it is much to the contractor's advantage to become as familiar as possible with the various ramifications of this constant source of expense. Many contractors falsely assume that compensation rates are standard and that every contractor would pay the same rate on a given job, but as a matter of fact only the basic rates and classifications are standard and every contractor has an individual credit or debit rating that may place his rates below or above the basic scale. Another common but costly error is improper or false allocation of payrolls. Improper allocation results from ignorance of the rate manual classifications or from carelessness, and is often not revealed until the final check of payrolls is made by the insurance carrier, months after the job has been finished. False allocations of payroll to low-rate classifications are responsible to a great extent for the increasing rates in low-hazard operations. Contractors are merely penalizing themselves in the long run by deliberately falsifying allocations. Contractors are not wholly to blame for their attitude towards compensation insurance, but indifference and inability to secure proper insurance information has proved costly to themselves as well as to the public. It is time that contractors became insurance-conscious.

Will the Public-Works Program Fail?

FOR SOME WEEKS concern over the public-works program has been growing throughout the country. The campaign was seen to be lagging seriously. As September waned, anxiety turned to apprehension, and fears arose that the entire program, keystone of the recovery arch, would fail. Many men indeed have become convinced that it already is a failure.

These fears and anxieties go to the heart of the national recovery movement. Not only is the lagging of the public-works campaign effort a grave threat to further progress, but loss of faith is a further ominous development. The public-works campaign does not involve merely the activity of a government organization but rests on countryside cooperation—the concrete expression of that national unity to which the President paid public homage but a few days ago.

It is thus vital that the facts be accurately known at the earliest moment. To this end *Engineering News-Record* has just made a survey of the country to determine the facts from which the present status and the prospects of the movement may be appraised.

The survey gives a brightly hopeful picture. It shows that concern over the public-works program is not now justified, and that the campaign is not a failure. There is vigorous activity everywhere. The PWA organization in the states is in successful and rapid action, and loan authorizations are going through in large numbers. States and cities are hard at work doing their part. In addition to the applications already submitted they have in preparation large further programs of work.

But if the PWA campaign is not a failure it also is not a success. It has not performed its essential mission of creating employment in measurable volume—surely not in volume large enough to impart momentum to industry and business — and as one result we are now witnessing a distinct retardation of business momentum. Loan authorizations are of no effect until converted into work. Construction of state and city works, the main objective of the PWA organization, has so far given work to but a few dozen men, and the ten or twelve millions of unemployed throughout the country are still waiting. That the summer season was thus wasted for construction reemployment is a national tragedy.

Nevertheless the outlook is most encouraging. If present and current approvals are transformed into construction quickly a great total of employment will result within the next three months. The winter's idleness and dole troubles will be lessened, and industry and business will receive the fresh impetus which they badly need.

A significant array of facts both favorable and unfavorable is brought to light by the survey. The favorable facts are that the PWA has achieved an excellent organization, that it is working efficiently and at high speed, that in most states the campaign has the strong support of the public and local government authorities, that there is a general will to make the Recovery Act work, and that the large total of projects yet to be converted into applications assures the campaign against exhaustion. Unfavorable factors are public apathy and inertia in some regions due to lack of understanding of the program requirements, inadequate means of preparing project plans and applications in small communities, restrictive legislation as to municipal debts, imperfect applications, and obstruction by red tape and confusing rulings at Washington. Lack of complete decentralization of the PWA organization is also declared responsible for delays. Finally, legal red tape in completing the steps necessary for starting construction is such as to waste many weeks of time.

The effect of these obstacles, added to the effect of the past delays, may be read in the detailed reports. In a number of states it has been concluded that little employment can result from the PWA campaign this year because of them. Should they continue to obstruct progress, the success of the public-works program will be seriously threatened.

Four major corrective measures are essential: a drive to complete local programs, legislative action to relax debt limits, elimination of red tape, and preparation for continuous winter work.

As to the first: Public inertia, apathy and misinformation, arising from the summer's delay at Washington, is in some states still great enough to threaten the success of the program. Educational campaigns to correct this situation are needed. Fortunately some such movements are already in progress. At the same time steps are necessary to see that projects go through into applications, and that these are so thoroughly prepared as to pass the scrutiny of the public works administration without revision and the resulting delay now so painfully apparent. Where small communities lack adequate technical assistance and cannot afford to employ it, organized state action to provide them with help appears warranted.

As to the second measure: Debt limits are the chief handicap to the program in a long list of states. Relaxation of the restrictions has already begun, some states having taken action in special sessions this summer, while others are to have legislation for this purpose shortly. Until the full import of these restrictions is recognized in all states, however, they are likely to continue being a bar to full development of recovery possibilities.

The third measure, elimination of red tape, requires not merely a humanizing of Circular 2 with its complex and excessive demands upon applicants but also more decentralization, more dependence by Washington upon the examination and review by its state representatives, and a drastic reduction of legal formality in the execution of loan contracts. These points are today the most critical elements of the entire public-works situation.

As to the fourth measure, preparation for winter work is essential because of the late start of the campaign and the probability that a rush of contract lettings will take place during the next two or three months. The necessity of winter work construction under these circumstances is so clearly evident that all plans and estimates obviously need to be based on the purpose of continuing every possible operation through the winter. The potential employment created by PWA projects will be of limited effect if deferred until spring after a brief start this fall.

In summary, the all important question is whether the public-works program will be made a success or a failure. Just now the program is progressing hopefully. But hopes may soon vanish unless the taxpayer learns that he will have to pay for breadline relief if he does not support job relief, unless the many sources of delay and obstruction to progress are removed, and unless Washington and Centerville get together with better spirit than now to speed up contract lettings and the issuance of pay checks.

NEWS OF THE WEEK

Second Large Dam On Columbia River Financed by PWA

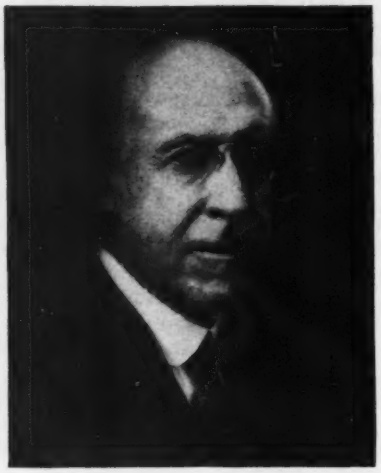
THE Public Works Administration, on Sept. 29, approved an allotment of $20,000,000 for the construction of a dam and six units of a power plant on the Columbia River at Bonneville, Ore. Total estimated cost of the work is $31,000,000. Bonneville is about 40 miles above Portland, Ore., and two miles below the Cascade Rapids in the Columbia River Gorge. The dam will make the river navigable up to the mouth of the Snake River. Its construction is to be carried out under the direction of the Corps of Engineers, U. S. A.

Several weeks ago the PWA tentatively allocated $63,000,000 to the construction of a dam at Grand Coulee in Washington.

Allotments for loans and grants for 45 non-federal projects were approved in the week ending Sept. 30. Details are given in the accompanying table.

A tentative allocation of $1,290,000 has been made to the Hillcreek Housing Corp., for a low-cost housing project in Philadelphia adjacent to Tacony Creek Park. The buildings will consist of 6-room residences and 3-story apartments providing 1,620 rooms at a rental of $7.50 per room.

The PWA board has allocated $1,383,442 to the Air Corps, largely for construction in the Canal Zone. Other federal allotments include $176,170 to the Signal Corps for underground conduit construction at army posts throughout the country, $3,000 for dike construction at the Radio Range Station, Oakland, Calif., and $44,000 for additional insect control work.



HARRISON P. EDDY
Official Nominee for President
American Society of Civil Engineers

DETAILS OF PWA LOANS AND GRANTS FOR NON-FEDERAL WORK

Locality	Project	Loan & Grant or Grant	Amount
Crete, Nebraska	Sewer	G.	$8,100
Prince George County, Md.	School Bldg.	L. & G.	408,000
Kennett, Mo.	Sewage	L. & G.	38,000
Near Bagnell Dam, Miller County, Mo.	School Bldg.	L. & G.	48,300
Union, Iowa	School Bldg.	G.	3,000
Toledo, Iowa	Street	G.	2,500
Ames, Iowa	Storm Sewer	G.	9,000
Ames, Iowa	Sewage	G.	6,000
Cedar Rapids, Iowa	Sewage	L. & G.	683,160
Boone County, Iowa	Construction	G.	12,000
Toledo, Iowa	Sewage	G.	2,500
Story County, Iowa	Highway	G.	14,100
Dallas County, Iowa	Secondary Rds.	G.	32,000
Newton, Iowa	Sewage	G.	10,000
Emmetsburg, Iowa	Waterworks	G.	6,500
Lohrville, Iowa	Municipal Building	G.	3,000
Cedar Rapids, Linn Co., Iowa	Secondary Rds.	G.	5,000
Pocahontas, Iowa	Storm Sewer	G.	900
Laconia, N. H.	Stock Farm	G.	7,000
Manchester, N. H.	Stock Farm	G.	6,500
Stoughton, Wis.	Waterworks	L. & G.	16,000
Republic County, Kan.	City Rd. Impr.	G.	4,000
Republic County, Kan.	City Rd. Impr.	G.	3,200
Cleveland, Ohio	Water	G.	800,000
Cleveland, Ohio	Sewage	G.	135,000
Nelson County, Va.	School	G.	11,000
Farhurst, Delaware	Building	G.	17,000
Rocky Mount, Franklin Co., Va.	Bldgs. & Rpr.	G.	2,000
Norwalk, Conn	Road Cons.	G.	14,000
Easton, Conn.	State Highway	G.	23,000
Oklahoma City, Oklahoma	Water	G.	1,500
South Omaha, Neb.	Bridge	L. & G	1,650,000
Massillon, Ohio	Intercepting Sewer	L. & G.	160,000
Albert Lea, Minn.	Repaving & St. Widening	L. & G.	167,000
Fairfax, Va.	Jail Building	L. & G.	50,000
Tama, Iowa	Storm Sewer	G.	6,000
Portsmouth, R. I.	School Building	L. & G.	90,000
Iola, Kan.	County Poor Farm	G.	5,500
Anchorage, Ky.	Street Construction	G.	25,000
Atchison, Kan.	Concrete Paving	G.	800
Atchison, Kan.	Resurfacing City Street	G.	6,500
McPherson, Kan.	Elevated Water Tank	G.	3,500
Oklahoma City, Okla.	Sewer	G.	16,500
Oklahoma City, Okla.	Street Construction Curbstones	G.	12,900
Whittingham, Vt.	Public School Building	G.	1,400
		Total	$4,527,360

Engineers' Code Hearing Set for October 10

A hearing on the code for the professional engineers' division of the construction industry is to be held in the New House Office Building, Washington, D. C., at 10 a.m., Oct. 10. Other hearings on supplemental codes of the construction industry scheduled to begin Oct. 10 are the tile and mantel contractors and metal furring and lathing.

Washington Notes

By Paul Wooton
Washington Correspondent

Recommendations made by the Conference of Mayors for speeding up handling of project applications are described by Secretary Ickes as "entirely feasible and just what we have been breaking our backs to do anyhow." Secretary Ickes said he did not wish to be understood as criticizing the attitude of the mayors' committee. He believes that its disposition is to be helpful and cooperative. Explaining the necessity for "keeping control here in Washington" and not giving the final decision to state advisory boards, he said that the headquarters staff, now working on double shifts, is being expanded and that when any state board is "unusually deliberative, we will spur them on from this end."

Putting on more people has flooded the Public Works Administration with requests for jobs. Some 20,000 to 25,000 applications are pending and Secretary Ickes states frankly that more time could be devoted to projects if selecting personnel did not require so much attention.

Since the Public Works Board issued its warning that road allotments would be withdrawn if laggard states do not promptly carry forward their construction programs, Arkansas, Louisiana, Michigan, Mississippi, Missouri, Oklahoma and South Carolina have let contracts, Illinois is advertising for bids and Georgia, Maryland, Indiana, Pennsylvania and New Jersey are the only states on which the PWA has not had reports of action. The question whether the PWA actually could withdraw state road allotments legally is still in the hands of counsel and will probably stay there as Secretary Ickes' bluff has had the desired effect.

Attorney General Cummings has not yet ruled on the question whether in connection with subsistence homesteading the law permits the federal government to purchase the land outright or whether the Public Works Administration can proceed only by assisting others to buy. Secretary Ickes states that it may be necessary to set up a corporation or some kind of a trusteeship to administer this phase of the public works program. He explained that subsistence homesteading is experimental and that projects of various types will be tried out with the $25,000,000 allotted by the law.

Earthquake Shocks Los Angeles, No Major Damage Reported

A strong earthquake of about five seconds duration shook the Los Angeles metropolitan area and the adjoining territory on Oct. 2 at 1:10 a.m. The area affected apparently centered in downtown Los Angeles and Pasadena, with the shock felt as far north as Santa Barbara and the Owens Valley, east to San Bernardino and Riverside and south to San Diego. There were sharp shocks at Long Beach, Compton and Huntington Park. No major damage has been reported. Most of the damage consisted of broken windows and dishes and some masonry shaken from older buildings. One death has been reported due to heart failure, and eight injuries due to broken glass and falling objects. The Los Angeles school officials have announced that no buildings will be used until a thorough inspection has been completed.

Contract Let for Lining of Midtown Tunnel at New York

The first contract for work on the Midtown Tunnel under the Hudson River at New York was let by the Port of New York Authority on Sept. 28. It went to the Bethlehem Steel Corp., and is for supplying 48,500 tons of cast-iron and 3,300 tons of cast-steel lining segments on a bid of $2,358,150.

At least 200 rings of lining must be ready for shipment by March 1, 1934, and must be supplied thereafter at a rate of not less than 200 rings per month. All must be ready by Jan. 1, 1935.

On Sept. 30 the War Department granted permission for the Construction of the tunnel. The top of the tube is to be not less than 60 ft. below mean low water at the shore and not less than 70 ft. at midstream. A temporary blanket at a depth of 40 ft. also was approved despite protest of shipping interests that it would interfere with vessels drawing 39 ft.

Chicago Requests Rehearing of Sanitary District Case

Protesting to the U. S. Supreme Court that its decision of last May directing the state of Illinois to assume financial responsibility for the sewage plant construction program of the Chicago Sanitary District (*ENR* May 25, 1933, p. 696) was "impracticable and impossible of execution," state attorney-general Kerner on September 30 submitted a report to the court renewing the state's request that a rehearing be granted on the lake-diversion case. The report states that the state is unable to assume the task of financing a $34,000,000 annual construction program in addition to spending $60,000,000 annually for unemployment relief.

However, the report makes clear that favorable action by the PWA upon a Sanitary District application for $7,874,477 with which to carry on uncompleted contracts may be expected to result in "rapid progress in accordance with the court's original requirements." It is contended by the attorney-general that the state's constitution makes impossible the use of the state's credit for the sewage-plant construction.

Municipal Engineers' Meeting To Be Reported Next Week

A staff report of the meeting of the American Society of Municipal Engineers held in Milwaukee, Wis., scheduled to appear in this issue, will be published in the Oct. 12 issue. The space set aside for that and other meeting reports in this issue was preempted by the telegraphic survey of the present status of PWA projects.

Florida Highway Bridge Burned

All but nine of the approach spans of the Pearl River bridge on the Poplarville-Bogalusa highway in the Mississippi were burned when the bridge approach was set fire recently by backfire from a stalled truck. The highway department is building a temporary low-water road across the Pearl River swamp for use until the bridge approach can be repaired.

Malcolm Pirnie Appointed Deputy Administrator of NRA

The National Recovery Administration has announced the appointment of Malcolm Pirnie, consulting engineer of New York City, to be a deputy administrator in charge of construction industry codes. He has recently been working as an assistant to deputy administrator Malcolm Muir. Mr. Pirnie is also mayor of Scarsdale, N. Y., and president this year of the American Water Works Association. His promotion to the rank of deputy administrator is recognition of the need for stimulating building construction and the production of the materials consumed by that industry. The construction code is regarded as the most important now before NRA officials. Work on the code is being expedited by the continued cooperation of the groups within the industry. A unified plan of procedure is being followed.

Secondary Roads Speeded Up

To get the large PWA secondary road program more actively under way the Bureau of Public Roads has sent out word that all the time-consuming regulations applying to roads feeding into main highways are temporarily abrogated. The new regulations expire Jan. 1, 1934. Under them states may begin work on projects without previous approval of plans and are not required to advertise for bids and to award contracts. It is required only that plans be prepared "simultaneously with the beginning of work." All checks on the work are retained. The order says: "The authority to continue this plan in use is contingent upon a faithful and satisfactory adherence to the detailed requirements for the conduct of each project. The district engineer is authorized to cancel a project for any one of the following causes: Inadequate or incompetent engineering supervision or management, incompetence or failure to keep proper records and payrolls of the forms prescribed, unreasonable prices or costs, inadequate types of construction and unacceptable workmanship."

As of Oct. 1, out of 2,033 road projects approved only 243 were secondary road projects. Only 136 secondary road projects were under actual construction and about 85 per cent of these were in the state of Maine.

Bonnet Carré Bridge Bids Rejected as Being Too High

The bids for construction of a highway bridge across the Bonnet Carré spillway above New Orleans, received by the Louisiana Highway Commission, have been rejected by the district engineerr of the U. S. Bureau of Public Roads. The low bid, that of the Koss Construction Co. and the Guthrie Construction Co., Des Moines, Iowa, of $1,519,865, was in excess of the estimated cost of $1,200,000, due to the fact that the bridge is to be built with PWA funds under the hours and rates prescribed by the Public Works Board.

LeRoy K. Sherman Named To PWA Board of Review

Announcement has been made of the appointment of LeRoy K. Sherman, consulting engineer of Chicago, Ill., as a member of the Technical Board of Review of the PWA. The creation of this board and a list of its members was reported in *Engineering News-Record*, Sept. 14, 1933, p. 331.

The recent announcement that Howard P. Emerson, of Washington, D. C., had been named a member of the board, was incorrect. The appointee was Merton L. Emerson, of Braintree, Mass., a consulting engineer.

Conference on Low-Cost Housing To Be Held in Cleveland

In the interests of both the construction and manufacturing industries and other organizations interested in one of the most promising sources of early business recovery, The Cleveland Engineering Society is sponsoring a National Conference on low cost housing, to be held in Cleveland on October 25, 26 and 27.

The general chairman of the conference will be Colonel Elliott H. Whitlock. The purpose of the conference will be to make an exhaustive study of the architectural, engineering, maintenance and planning problems arising in those individual or group family units whose cost does not exceed $5,000.

A tentative program has been arranged with Councilman E. J. Bohn as chairman of the opening session. This will be followed by a series of sessions, to be presided over by nationally known architects, engineers, publishers, and manufacturers. The meetings will be sufficiently informal to permit general discussion by those interested in any phase of the problem. All of the new materials, and services, such as air conditioning, sound proofing, sanitation and methods of fabrication known to date, will be subjected to a critical analysis and new methods will be proposed that will intelligently direct further research among equipment manufacturers, in order to satisfy the country's most urgent need at this time—a proper and economical housing for the greatest number of our citizens.

Organizations invited to cooperate include the Cleveland Chamber of Commerce, Real Estate Board, the housing division of The Federal Public Works Administration, The American Institute of Architects and the various national engineering and trade associations.

Rapid Progress Being Made On Norris Dam Preliminaries

Exploration of the limestone at the site of Norris Dam has proceeded far enough to indicate that an entirely satisfactory foundation is available at the original location. Results of core drilling on which the site was selected have been confirmed by geophysical surveys. Meantime, plans are proceeding rapidly for the early undertaking of construction operations on the dam with large forces.

Design of the dam is being pushed as fast as practical by the Denver office of the Reclamation Service. The final plans will be entirely different from the preliminary sketches on which the original estimates were based. The barge lift has been eliminated. The location of the power house has been changed. The emergency spillway in rock beyond one end of the dam has been left out and the capacity of the main spillway increased to 250,000 second-feet. It is expected that the design will be ready so construction may proceed as soon as the foundation is prepared and the construction plant is assembled.

C. H. Locher, construction consultant on the project, has practically decided to use the cableway method of building the dam. Tests thus far completed show that crushed stone and sand prepared from the limestone formation at the site produce better concrete than sand and gravel from adjacent streams.

This favorable development has led to the further decision not to build a branch rail line to the site. To bring in the cement, steel, equipment, machinery and other supplies and materials needed, a highway will be built on easy grades and with flat curves. This new grade will be surfaced with crushed stone treated with bituminous material. Considerable highway surface maintenance is expected to be necessary during the construction period. After the job on the dam is done the plan is to place a concrete or other high-type surface on the highway grade. The elimination of the rail connection proposed in the original estimates will save about $500,000.

Production of the more than 1,000,000 cu.yd. of sand and rock required will be handled as a part of the job. Complete quarrying and crushing equipment will be installed.

Barton M. Jones has been retained as construction engineer on Norris Dam by the Tennessee Valley Authority. Mr. Jones was in charge of construction of the Lockington Dam of the Miami Conservancy project. He afterwards handled various flood-control and hydraulic operations in the Rocky Mountain section, including the flood-control works at Pueblo, Colorado.

Ross White has been retained by the Authority to act as superintendent of the construction of Norris Dam. Mr. White has had extensive experience on various dams and other works in the West, his most recent post being as engineer of construction on the Pine Canyon Dam.

In response to aggressive local agitation for the Authority to build Dam No. 3 on the Tennessee River, Dr. A. E. Morgan, chairman of the Authority, issued the following statement recently.

"The Tennessee Valley Authority heartily approves the construction of Dam No. 3 above Muscle Shoals on the Tennessee River as an emergency employment relief measure, on the condition that it is built with public works money and not with Tennessee Valley Authority funds, and that the carrying charges and construction cost shall not be charged to the Tennessee Valley Authority until the demand for power justifies the construction for that purpose. The dam (No. 3) is an integral part of the navigation program for the Tennessee River, and will be a part of the power development program (of the Authority) when it is needed. The only disadvantage to building the dam now is that it will not come into full use at once. This disadvantage may be overweighed by the great advantage of providing employment, by favorable construction prices and the fact that the construction of Dam No. 3 will be a substantial aid to navigation on the Tennessee River below Chattanooga. The navigation lock is, in fact, now in process of construction at Dam No. 3."

Two River-Development Boards Named by PWA Administrator

An Arkansas Basin Committee to study all projects which have been proposed for further development of the Arkansas River has been appointed by the Federal Administrator of Public Works. The board will report to the recently-created Mississippi Drainage Area Board. A similar committee has been named for the Red River.

The Arkansas Basin Committee consists of: N. R. Graham, Tulsa, Okla., chairman; Henry Tucker, Little Rock, Ark.; E. P. Bradley, Hutchinson, Kan.; Peter E. Burrus, Joplin, Mo.; Arch Hurley, Tucumcari, New Mex.; Henry C. Vidal, Denver, Colo.; A. S. Stinnett, Amarillo, Tex. The Red River Basin Committee consists of: O. N. Floyd, Dallas, Tex., chairman; Walter Archibald, Durant, Okla.; Henry Moore, Texarkana, Ark.; Gervais Lombard, New Orleans, La.

Each committee has been instructed to organize at once and place preliminary data in the hands of the Mississippi River Area Board at the earliest possible date so that the Mississippi board may consider them in making its report.

M. G. Barnes Honored by Tablets on Illinois Waterway Structures

Two memorial bronze tablets honoring the late M. G. Barnes, chief engineer, Illinois Division of Waterways, have been placed on the front walls of the control houses at Starved Rock lock and dam and the Lockport locks by the Mississippi Valley Association, the Illinois Manufacturers Association, the Chicago and the Illinois Chambers of Commerce. This action was taken to give concrete evidence of the state's indebtedness to Mr. Barnes incessant labors and practical engineering analysis of the waterway requirements. Former designs clung to the idea of deep waterways and small lockage capacity. Mr. Barnes' design called for a waterway of the barge canal type of moderate draft and with long, wide locks for fleets of barges having a tonnage equal to four 50-car trains.

Mr. Barnes died in 1930 when the canal was substantially completed from an illness brought on by his work upon its construction.

SOCIETY CALENDAR

AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS, annual meeting, Milwaukee, Wis., Oct. 9-11.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION, annual meeting, Chicago, Oct. 17-21.

AMERICAN PUBLIC HEALTH ASSOCIATION, annual meeting, Indianapolis, Ind., Oct. 9-12.

HIGHWAY RESEARCH BOARD, National Research Council, Washington, D. C., Dec. 7-8.

NATIONAL ASSOCIATION OF RAILWAY AND UTILITIES COMMISSIONERS, annual meeting, Cincinnati, Ohio, Oct. 10-12.

NATIONAL CONFERENCE ON LOW COST HOUSING, sponsored by the Cleveland Engineering Society, is to be held in Cleveland Oct. 25-27.

Personal Notes

T. A. WILSON, of Sikeston, Mo., has been named secretary of the Missouri state highway commission.

W. H. COURTENAY, chief engineer of the Louisville & Nashville Railroad, has been appointed consulting engineer and G. R. Smiley, who was assistant chief engineer, has been appointed chief engineer to take his place.

E. E. PARKER, for many years city engineer for Madison, Wis., has resigned and has accepted the position of deputy highway engineer of Wisconsin in charge of all highway construction in cities under the public works program.

JOHN T. CROWLEY, for the past 35 years with Fred T. Ley & Co., Inc., Springfield, Mass., has organized the contracting firm of the John T. Crowley Construction Co., Inc., at Cambridge, Mass. The firm will specialize in conduits, cell construction, pipe lines, foundations, steel erection and trackwork.

H. WEBSTER SMITH, chairman of the Public Improvement Commission, Baltimore, Md., which supervises the expenditures for public works in that city, has resigned. He served as chairman since 1930. Upon the request of the Mayor, he has agreed to remain in the post until his successor is appointed.

WILLIAM J. TITUS, former chief engineer of the Indiana state highway department, has been named senior highway design engineer for the federal bureau of roads. He begins work at once under J. T. Voshell, Chicago district engineer, and has been placed in charge of all bridge and railroad grade separation construction for Indiana, Illinois, Michigan and Kentucky. In addition, he will be in charge of all municipal projects undertaken by the Indiana state highway commission with money allotted to Indiana under the federal public works act.

Correction Note

In a personal published in this column in our issue of Aug. 31, it was stated that Christopher J. Carven, recently appointed commission of public works of Boston, succeeded the late Louis K. Rourke. This statement was in error. Mr. Carven succeeds Joseph A. Rourke, who recently retired from the position of public works commissioner.

Obituary

JAMES HINDS, town engineer of Winchester, Mass., died in that place on Sept. 25, at the age of sixty-three.

RUFUS S. TILDEN, manager of the New York and New Jersey Common Brick Manufacturers Association, died on Oct. 1 at Farmingdale, L. I. He was 46 years of age.

JOHN LAWRENCE MAURAN, senior member of the architectural firm of Mauran, Russell & Crowell, of St. Louis, Mo., died of peritonitis at Peterboro, N. H. on Sept. 23. He was 66 years old.

JOHN HILL, 80 years old, president of the John Hill Construction Co., St. Louis, Mo., died in that city on Sept. 27. Mr. Hill was a native of Errol, Scotland, and came to this country sixty years ago.

HARRY T. BOSTIAN, civil engineer of Seattle, Wash., died in that city recently at the age of 70. He was formerly city engineer for Ballard, Wash., and for six years served as engineer for the Duwamish Waterway.

CHARLES PIEZ, chairman of the board of the Link-Belt Co., of Chicago, Ill., died of pneumonia on Oct. 1 at the age of 67. During the war Mr. Piez was selected by the United States Shipping Board to be vice-president and general manager of the Emergency Fleet Corp. and in that position he directed the expenditure of the three billion dollar shipbuilding program.

JOSEPH M. MICHAELSON, chief designing and consulting engineer of the Bureau of Yards and Docks, United States Navy Department, died in Washington on Sept. 17. He was 72 years old. Mr. Michaelson received his degree in civil engineering at Cornell University and later held responsible positions in the fields of bridge engineering and general construction for 16 years before entering the Government service in 1901.

KEMPER PEABODY, who was general supervisor of buildings of the New York Central Lines east of Buffalo at his retirement in 1931, died on Sept. 26 at his home at New Rochelle, N. Y. His age was 72. He had served the railroad for 30 years. Mr. Kemper entered the employ of the Chicago Great Western Railway in 1897, being engaged in civil engineering and construction work until 1901, when he began his connection with the New York Central.

RICHARD G. HARTSHORNE, sales manager of the New England Structural Company, Everett, Mass., died at the Peter Bent Brigham Hospital, Boston, on Sept. 26. He was born in Wakefield, Mass., fifty-two years ago, and was graduated from Massachusetts Institute of Technology in 1904.

C. H. BOWMAN, highway engineer of the Casper district in Wyoming, and former state highway engineer, took his own life on Sept. 29. His action was attributed to ill health. After serving as district engineer for nearly fourteen years at Casper, Mr. Bowman became state highway engineer last June. After a short time in office he resigned because of his health. He recently had recovered sufficiently to take up his old duties at Casper.

Contracts and Capital

CONSTRUCTION

(Thousands of Dollars)

	Weekly Average Four Weeks Oct., 1932	Week Oct. 5, 1933
Federal Government	$6,263	$9,525	$14,963
State and municipal	13,700	14,814	18,322
Total Public	$19,963	$24,339	$33,285
Total private	5,240	8,682	6,319
Week's total	$25,203	$33,021	$39,604
Cumulative to date:			
1932		$939,897	
1933		716,342	

NEW PRODUCTIVE CAPITAL

(Thousands of Dollars)

	Week Oct. 5, 1933	Cumulative, 1933
Public:		
State and municipal issues	$1,708	$218,041
PWA loans and grants	14,674	591,510
Total public	$16,382	$809,551
Private:		
Corporate issues	.....	$46,347
PWA loans	$1,290	38,204
Total private	$1,290	$84,551
Total private and public	$17,672	$894,104
Cumulative, 1932		$582,250

Note—These new capital figures include all private bond and stock issues sold for new productive purposes; all state and municipal bonds sold for construction purposes; all R.F.C. advances made on previous commitments on self-liquidating loans; and loans and grants made by the Public Works Authority to states, municipalities and private corporations for new construction work, including the special highway fund, but excluding all federal allotments from the PWA fund for federal projects that would ordinarily be financed by regular federal appropriations.

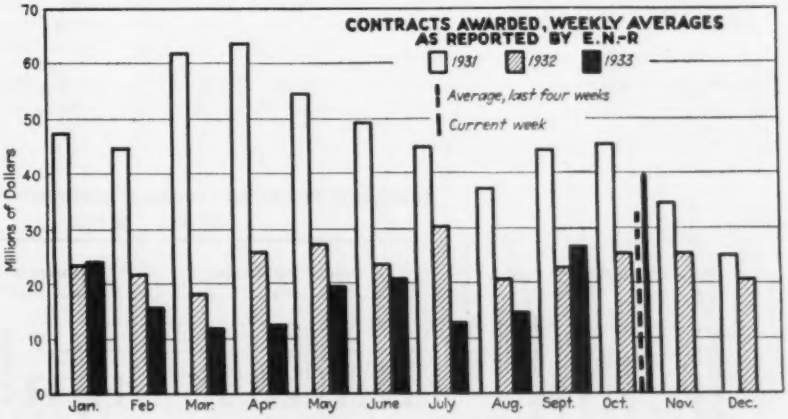
ENR Cost and Volume Index

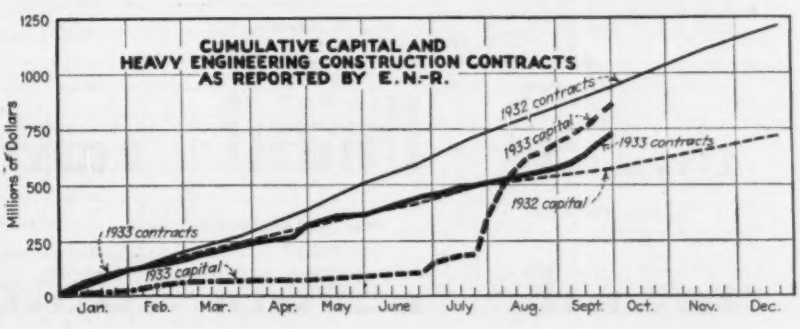
E.N.R.-Cost		E.N.R.-Volume	
October, 1933	**187.74**	**September, 1933**	**122**
September, 1933	175.48	August, 1933	73
October, 1932	159.16	September, 1932	124
1932 (Average)	156.97	1932 (Average)	127
1931 (Average)	181.35	1931 (Average)	220
1930 (Average)	202.35	1930 (Average)	260
1913 (Average)	100		

Engineering Contracts and Capital

HEAVY engineering construction contracts reported for the past week total $39,604,000, a slight loss from the high previous week's awards of $41,206,000. Public works, aided by federal contracts amounting to $14,963,000, reached the high total of $33,285,000. Federal awards were the highest of the year. Highway lettings continued strong with $11,299,000 reported in awards. Private contracts suffered a set-back, dropping from $16,566,000 the previous week to $6,319,000. A railroad reconstruction contract in Kansas accounted for $2,000,000 of the private total. The Grand Island bridge near Buffalo, amounting to $2,464,000, was the largest single project let during the week. New York led the list of states awarding highway contracts, this state's lettings aggregating $2,630,000. Indiana and Missouri let road contracts in excess of a million dollars each. Another large award was for tunnel liner plates for the Mid-Town tunnel at New York City, amounting to $2,358,000. Most of the federal awards for the week were for levee and other river work. Cumulative contracts to date this year total $716,342,000, as compared with $934,657,000 for last year.

New productive capital for the week amounted to $17,672,000, of which $1,708,000 was in state and municipal bond issues, $14,674,000 was in PWA loans and grants to municipalities and $1,290,000 was in PWA loans to private housing corporations. To date the PWA has allotted $591,510,000 to states and municipalities.





Business Side of Construction

Heavy Awards Gain 78 Per Cent; Cost Index Continues to Rise

STIMULATED by the public works program, heavy engineering construction contracts awarded in September (four weeks) totaled $106,677,000, or an average of $26,669,000 per week, a weekly contract figure that has not been surpassed since July, 1932. Public works amounted to $73,732,000, or an average of 18.5 millions per week, the highest since January, 1933. Private contracts were unusually high $32,945,000, or 8.2 millions per week. All contracts in September showed a gain of 78 per cent over those reported in August. Along with the gain in construction volume, costs continued to rise, the *Engineering News-Record* Cost Index jumping over 12 points to 187.74. The Index now stands at the same level as it was in June, 1931, following an unsteady rise since the low of 152.20 reached in June, 1932. A rise of over 5c. per hour in the common labor rate component of the index and a rise in steel prices accounted for the increase, the largest monthly advance since September, 1922.

Highway lettings, due to the federal road program getting well under way, averaged 9.2 millions per week in September, the highest in a year. Road awards steadily increased during the month, reaching over 13 millions the final week. Federal construction also reached the highest point of the year last month, averaging 6 millions per week. Following an administration order in March, practically no federal work was let until the middle of September.

In the geographical distribution of contracts, the area between the Mississipp and the Rocky Mountains led the rest o the country with a weekly average of 8.8 millions in awards, the heaviest for thi section in over two years. The Middl Atlantic states were next with 7.2 million per week, the highest of the year. Th South and Middle West sections also registered new highs for the year with averages of 3.0 millions and 3.4 millions per week, respectively. New England showed no increase, remaining at an average o 1.2 millions, while the Far West gained slightly with an average of 3.1 millions per week.

Materials notes

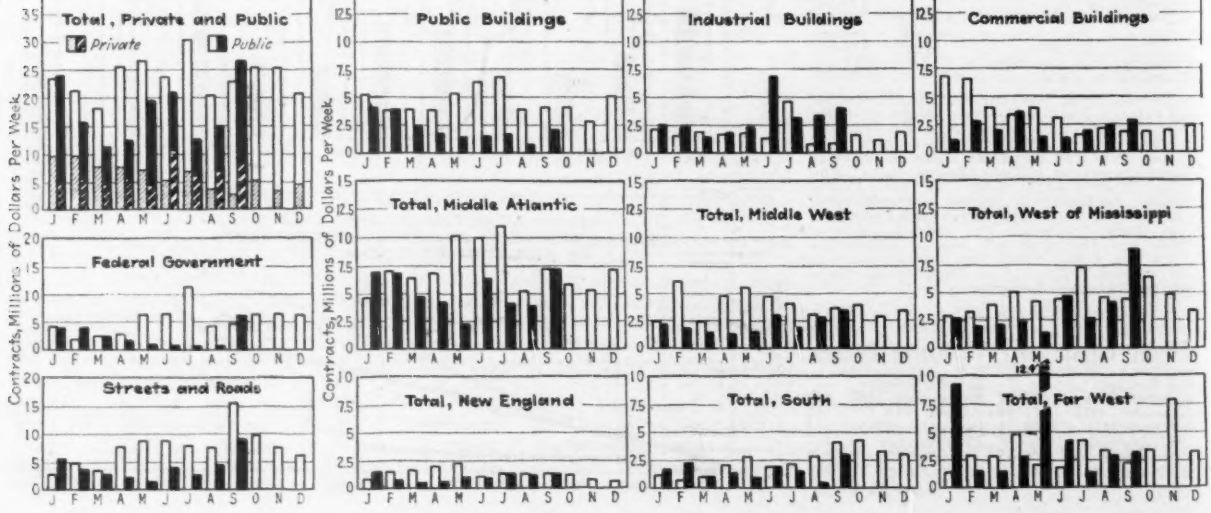
The construction commodity markets were unsettled during the month because of pending code provisions, though increases in prices prevailed in most markets. The long-expected increase in steel prices became effective Oct. 2, when structural shapes and plates advanced $2 per ton and bars advanced $3. Rails held steady at $40, though pressure was brought to bear by the administration to lower this rate with the expectation railroads would resume buying. Several roads entered orders at this price, while others are hold-

ENGINEERING CONSTRUCTION CONTRACTS REPORTED IN SEPTEMBER, 1933

Four Weeks—Thousands of Dollars (000 omitted)

	New England	Middle Atlantic	South	Middle West	West of Mississippi	Far West	United States Sept., 1933	United States Nine Months 1933	United States Nine Months 1932	Canada Sept., 1933
Public Works										
Waterworks	146	126	214	1,480	70	317	2,553	61,700	22,527	83
Sewers	47	50	...	318	67	251	733	12,051	19,882	20
Bridges, public	306	1,164	676	236	1,040	353	3,775	59,459	40,728	1,445
Earthwork and waterways	75	116	3,845	96	15,565	1,169	20,866	47,825	65,699	57
Streets and roads	2,719	5,297	4,022	4,287	13,116	7,171	36,612	153,820	281,271	56
Buildings, public	293	6,481	527	433	182	591	8,507	80,676	186,823	180
Unclassified, public	52	222	45	61	2	504	886	11,364	34,215	70
Total Public	3,638	13,456	9,329	6,911	30,042	10,356	73,732	426,895	651,145	1,911
Federal gov't. (included in above classifications)	100	2,072	4,362	138	15,581	1,829	24,082	84,633	190,267	....
Private										
Bridges, private	....	837	150	25	1,786	15	2,813	7,810	3,694	....
Buildings, industrial	865	4,503	2,177	3,611	2,483	1,981	15,620	122,714	72,336	70
Buildings, commercial	485	9,504	150	1,430	.....	.....	11,569	79,638	139,634	....
Unclassified, private	68	626	265	1,498	470	16	2,943	39,681	47,885	....
Total private	1,418	15,470	2,742	6,564	4,739	2,012	32,945	249,843	263,549	70
September, 1933 (4 Weeks)	**5,056**	**28,926**	**12,061**	**13,475**	**34,781**	**12,388**	**106,677**	.....	.....	**1,981**
August, 1933 (5 weeks)	5,900	18,824	2,502	13,948	20,380	12,509	74,063	.....	.....	4,342
September, 1933 (5 weeks)	6,315	36,253	20,847	17,781	22,253	11,038	114,487	.....	.....	3,500
Nine months, 1933	37,942	198,921	59,664	85,776	132,846	161,609	.....	676,738	.....	20,321
Nine months, 1932	60,154	322,599	82,072	161,251	174,828	113,790	.....	.....	914,694	37,524

CONTRACTS REPORTED - WEEKLY AVERAGES - 1932-1933



ing off. Lumber prices were uncertain in most centers. Cement prices held steady during the month.

The construction commodity quotations given in the following pages have been completely revised this month to make them more definite and more effective. It was impossible to get some of the desired quotations in time for this issue, but the list is expected to be complete by next month.

Lumber—Production and shipments of lumber steadily decreased during September, according to reports of the National Lumber Manufacturers Association, though new orders showed an upturn during the last two weeks. Following an increase during the summer months, the lumber business is now back to about the same as last April and May.

Cement—The production of portland cement during August is reported by the Bureau of Mines as 8,223,000 bbl., an increase of 5 per cent over the same month last year. Shipments for the month totaled 5,994,000 bbl., a drop of 45.5 per cent from August, 1932. Stocks on hand at the end of the month amounted to 22,077,000 bbl., a gain over the supply on hand a year ago amounting to 13.8 per cent.

Steel—According to the American Iron & Steel Institute, production of steel ingots in August amounted to 2,900,611 tons, rated at 49.42 per cent of capacity of the industry. This rate declined during September to an estimated figure of 38 per cent during the final week. Strikes in the Wheeling and Pittsburgh districts pulled the output down at least 2 per cent, according to estimates. This rate is expected to hold for October, though an increase is looked for towards the end of the month. The American Institute of Steel Construction reports that booking of steel construction in August amounted to 75,688 tons, a gain of 50 per cent over July bookings, while shipments amounted to 66,644 tons, as compared with 51,303 tons for July. Both shipments and bookings for August were well ahead of the average for 1932 and the first half of this year.

Labor notes

Reports of increased employment are coming in from all sections of the country. Estimates place the number of workers finding jobs since the N.R.A program went into effect at 2,500,000. The Bureau of Labor Statistics reports a payroll index increase from 42.7 in July to 48.5 in August, while the average number of hours worked per week fell from 42.3 to 38.6 in the same period. The *ENR* compilation of average common construction wage rates rose from 45.24c. Sept. 1 to 50.57c. Oct. 1. Skilled construction wage rates rose from $1.016 to $1.029 in the same period. Common rates are now at the highest point since June, 1931.

Washington, D. C.—A dispute between carpenters and ironworkers over jurisdiction in installation of metal radiator covers has tied up three federal buildings under construction at the capital and has thrown 1,000 men out of work. Bricklayers are threatening to go out on the Central Heating plant job unless they are permitted to install the calking around the windows. Boilermakers are claiming the right to install smokestack ducts on the same job, now being done by ironworkers. The carpenters have refused to go back to work pending settlement of the radiator cover dispute, though the contractor has announced willingness to suspend this operation until a settlement is reached.

New York City—Demanding abolition of all overtime, 16,000 painters went on strike for a week in greater New York until their demands were met by employers. Double time will be paid for all unavoidable overtime work and for work on Sundays and holidays.

Newark, N. J.—Bricklayers throughout Essex County went on a one-day strike, threatening to tie up the Newark post-office job. The men returned to work the next day pending hearings on the wage scale. Union bricklayers contend the former agreement of $13.50 per day is still in effect, though the expiration date was March 15 last. Contractors are offering a $12 rate pending a new agreement when a code for the industry is put into effect.

New Jersey—The state highway board has accepted a minimum wage rate of 40c. on state work. Organized labor interests were trying to set the minimum at 50c. The board admitted a higher rate might be applicable to bridge work, and asked the labor organizations to submit a list of projects deserving a higher rate.

Colorado—A dispute between contractors and trucking interests over truck hire rates was settled by the state industrial commission. Trucks will be paid for at the rate of 87½c. per hour, and drivers will receive an additional 60c.

New York—A minimum of $1.20 per hour for skilled labor will be paid on all city contracts, though previous agreements between unions and contractors will not be disturbed.

Indiana—A minimum of 47c. for unskilled and 55c. for skilled labor will be paid on all state highway work.

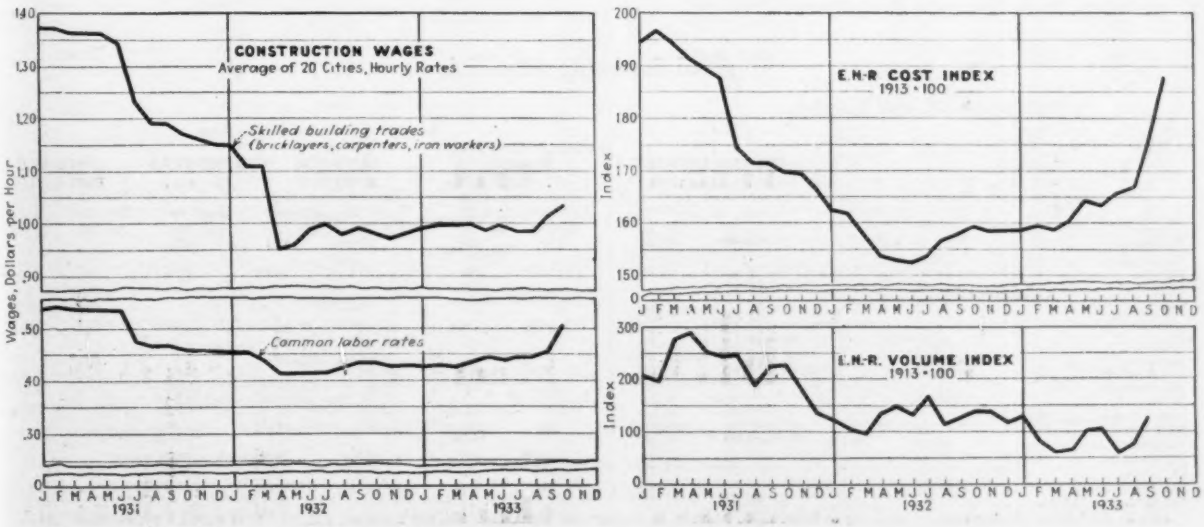
Ohio—Skilled labor on highway work will receive a minimum of 60 to 90c. per hour and unskilled labor will get a minimum of 40 to 52½c., according to location.

New Orleans—Wage disputes on the Public Belt Ry. bridge across the Mississippi are as yet unsettled, though work is continuing under temporary wage scales pending final settlement. The contracts were formally awarded last December on bids taken two years ago.

ENR Cost and Volume Index

Increasing labor costs and an increase in steel prices forced the *Engineering News-Record* Construction Cost Index up over 12 points to 187.74 for October. The September Index stood at 175.48. The common labor average jumped from 45.24c. to 50.57c. Steel advanced 10c. per 100 lb. Lumber fell off slightly, while the fourth component, cement, remained stationary. The *ENR* Construction Volume Index rose from 73 in August to 122 in September the highest since last November.

E.N.R.-Cost		E.N.R.-Volume	
October, 1933	**187.74**	**September, 1933**	**122**
September, 1933	175.48	August, 1933	73
October, 1932	159.16	September, 1932	124
1932 (Average)	156.97	1932 (Average)	127
1931 (Average)	181.35	1931 (Average)	220
1930 (Average)	202.35	1930 (Average)	260
		1913 (Average)	100



Current Prices of Construction Materials

Cement, Aggregates and Ready-mixed Concrete

	PORTLAND CEMENT — Per bbl., carload lots, f.o.b. city, including cost of bags			SAND AND GRAVEL — Per ton, carload lots, f.o.b. city			CRUSHED STONE — Per ton, carload lots, f.o.b. city		CRUSHED SLAG — Per ton, carload lots, f.o.b. plant		CONCRETE — Ready Mixed
	Cloth Bags*	Paper Bags	Bulk	Gravel, 1½ in.	Gravel, ¾ in.	Sand	Stone, 1½ in.	Stone, ¾ in.	Slag, 1½ in.	Slag, ¾ in.	1:2:4, 50c.y. or more, delivered
Atlanta	$2.64	$2.49	$2.49	$1.90	$1.90	$1.45	$1.90	$1.90	$1.90	$1.90	$8.00
Baltimore	2.75	2.50	2.30	1.80‡	2.00‡	1.20‡	1.75‡	1.75‡	2.25	2.25	6.75
Birmingham	2.67	2.42	.....	3.00†‡	3.00‡†	2.40†‡	.....	.....	.80	.80	5.75
Boston	2.72	2.47	2.27	1.50	1.50	1.10	1.50	1.50	.....	.....	6.00
Chicago	2.75	2.50	2.00	2.50†	2.50†	2.25†	2.50†	2.50†	.....	.....	.....
Cincinnati	2.96	2.71	.....	1.20	1.20	.90	1.65	1.65	.....	.....	6.50
Cleveland	2.52	2.27	.....	.....	1.65	1.55	1.61	1.61	1.75	1.75	7.50
Dallas	2.45	2.20	1.95	1.40	1.40	1.65	1.80	1.90	.....	.....	6.50
Denver	2.85	.....	.....	1.85	.....	1.25	.....	.....	.....	.....	.....
Detroit	2.27	2.02	1.82	1.15	1.05	.85	.72	.72	.90	.90	5.75
Kansas City	2.87	2.62	2.20	.65	.65	.50	1.25	1.25	.....	.....	7.50
Los Angeles	2.90	2.65	.....	1.90	1.90	1.40	1.90	1.90	.....	.....	.....
Minneapolis	2.85	.....	2.40	1.00	1.00	.25	1.00	1.00	.....	.....	6.50
Montreal	.....	1.70	.....	.....	1.50	1.35	.....	1.25	.....	.....	.....
New Orleans	.....	.....	2.20	1.60	1.60	1.30	.....	.....	.....	.....	6.05
New York	2.90‡	2.65‡	.....	1.50†	1.50†	1.00†	1.75†	1.75†	.....	.....	7.75
Philadelphia	2.49	2.24	.....	1.85‡	1.85‡	1.52‡	2.20‡	2.20‡	.....	.....	6.84
Pittsburgh	2.52	2.27	1.65	1.50‡	1.50‡	1.70‡	2.25‡	2.25‡	1.25	1.25	7.00
St. Louis	2.49	2.24	.....	1.95‡	1.50‡	1.65‡	1.05‡	1.05‡	.75§	.75§	7.20
San Francisco	2.45	2.25	2.00	1.75	1.75	1.75	1.65	1.65	.....	.....	.....
Seattle	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

*Includes 40c. per bbl. for bags, 10c. allowed for each returnable bag. †Per cu. yd. ‡Delivered. §F.o.b. Granite City, Ill.

CURRENT MILL PRICES CEMENT TO DEALERS, CARLOAD LOTS, F.O.B. MILL

Charge for bags not included. For cloth bags, add 40c. per bbl.; 10c. refund allowed for each returnable bag; for paper bags add 15c. per bbl., not refundable.

	Bagged	Bulk		Bagged	Bulk		Bagged	Bulk
Alpena, Mich	1.65	1.60	Iola, Kans	1.70	1.65	Richard City, Tenn	1.70	1.65
Buffington, Ind	1.60	1.55	La Salle, Ill	1.60	1.55	Saginaw, Mich	1.65	1.60
Dallas, Tex. (Inc. 5c. tax)	1.80	1.75	Limedale, Ind	1.60	1.55	Steelton, Minn	1.80	1.75
Hannibal, Mo	1.60	1.55	Mason City, Ia	1.70	1.65	Universal, Pa	1.65	1.60
Hudson, N. Y	1.75	1.70	Norfolk, Va	1.76	1.71	Waco, Tex. (Inc. 5c. Tax)	1.80	1.75
Independence, Kans	1.70	1.65	Northampton, Pa	1.65	1.60	Wyandotte, Mich	1.60	1.55
Ironton, Ohio	1.60	1.55	North Birmingham, Ala	1.75	1.70			

Structural Clay Building Tile, Brick and Lime

	STRUCTURAL CLAY TILE — PARTITION — Per M, lots of 2,000 pieces or over, delivered			STRUCTURAL CLAY TILE — LOAD BEARING — Per M, lots of 2,000 pieces or over, delivered			BRICK — Per M, in quantity, delivered		LIME — Per ton, in paper, carload lots, delivered		
	3x12x12 in.	4x12x12 in.	8x12x12 in.	8x12x12 in.	10x12x12 in.	12x12x12 in.	Common backing	Straight hard	Hydrated finishing	Common hydrated	Pulverized or lump
Atlanta	$86.80	$92.60	$173.70	$208.40	$243.20	$277.90	$8.00	$8.00	$17.50	$10.94	$10.94
Baltimore	60.00	62.50	125.00	132.00	190.00	220.00	14.00	15.00	16.00	12.00	20.00
Birmingham	.....	89.00	167.00	.....	219.00	250.00	10.00	.....	.....	.....	.....
Boston	77.50	97.50	182.70	194.00	239.00	273.00	13.50	16.50	19.00	15.00	17.65
Chicago	58.50	62.40	85.80	.....	.....	.....	9.20	10.20	18.00	18.00	16.00
Cincinnati	.....	68.15	.....	.....	.....	.....	16.00	.....	11.00	9.65	.....
Cleveland	45.00	48.00	90.00	117.00	136.50	156.00	16.00	16.00	30.00	22.00	.....
Dallas	82.75	90.00	163.50	196.00	195.75	233.00	.....	15.50	18.50	.....	.....
Denver	75.00	80.00	135.00	135.00	185.00	220.00	11.75	25.50	18.00	16.00	2.60§
Detroit	60.00	64.00	120.00	170.00	200.00	250.00	11.50	12.00	20.00	20.00	16.00
Kansas City	62.50	75.00	140.50	.....	150.00	.....	13.00	.....	.60‡	.55‡	.50‡
Los Angeles	77.50	94.25	134.00*	188.00	232.50	311.50	11.50	.....	18.70	.....	19.70
Minneapolis	77.00	84.00	143.00	165.00	173.00	240.00	10.00	18.00	25.50	21.00	.....
Montreal	.....	110.00	.....	.....	260.00	.....	19.00	32.00	20.00	16.00	16.00
New Orleans	.....	.....	.....	.....	.....	.....	.....	.....	23.00	12.50	1.95§
New York	81.00	86.00	129.00	193.30†	238.80†	295.60†	12.75	.....	19.00	15.00	20.00
Philadelphia	.....	65.00	140.00	.....	175.00	195.00	13.00	.....	.....	.....	.....
Pittsburgh	52.00	55.60	104.20	118.00	155.00	192.00	15.00	20.00	16.50	15.50	17.40
St. Louis	.....	60.00	112.00	.....	155.00	190.00	12.00	14.00	.55‡	.40‡	2.25§
San Francisco	68.00	76.50	174.00	.....	.....	.....	14.00	.....	22.50†	19.00†	.....
Seattle	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

*6x12x12 in. †F.o.b. Perth Amboy, N. J. ‡Per sack. §Per bbl.

Road Surfacing Materials

	PAVING BRICK AND BLOCKS — Granite Blocks per M, lots of 50,000, 4x8x4 in., dressed f.o.b. city	Brick per M, 3x8½x4 in., carload lots f.o.b. city	Wood Blocks per sq.yd., 3½ in., 16-lb. treatment, f.o.b. city	PAVING ASPHALT — Per ton, less than 80 penetration, f.o.b. city Tank car	Drums	ASPHALT BINDERS—FLUXES — Per gal., 80-300 penetration, f.o.b. city Tank car	Drums	CUTBACK ASPHALT — Per ton, f.o.b. city Tank car	Drums	ROAD OILS — Per gal., f.o.b. city Tank car	ASPHALT EMULSION — Per gal., f.o.b. city Tank car	Drums
Atlanta	$3.00*	$35.00	$2.25	$17.20	$21.20	$0.068	$0.10	$19.20	$27.22	$0.068	$0.105	$0.105
Baltimore	130.00	43.00	1.90	15.00	19.00	.06	.08	.07†	.10†	.055	.....	.....
Birmingham	65.00	25.00	.....	11.00	.....	.....	.....	.....	.....	.....	.06	.....
Boston	65.00	32.00	2.00	14.00	18.00	.055	.09	.07†	.105†	.055	.09	.145
Chicago	3.80*	36.00	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Cincinnati	110.00	36.50	.....	.....	.....	.....	.....	.....	.....	.....	.075	.....
Cleveland	125.00‡	37.50	.....	17.50	21.50	.....	.....	.....	.....	.....	.....	.....
Dallas	.....	.....	.....	11.85	16.85	.0948	.1448	15.00	21.00	.02	.08	.11
Detroit	.....	34.50	.....	14.29	16.88	.....	.....	13.94	17.94	.....	.....	.....
Kansas City	.....	33.00	2.75	12.00	17.00	.05	.09	.07	.11	.04	.05	.09
Los Angeles	.....	48.50	.....	12.00	16.00	12.00#	16.00#	14.00	.....	.042	.0525	.1125
Minneapolis	.....	.....	2.50	17.30	21.30	.065	.105	19.60	32.20	.048	.....	.....
Montreal	.....	100.00	.....	13.00	18.66	.....	.....	.....	.....	.....	.....	.....
New Orleans	200.00	.....	.....	13.00	18.00	.....	.....	.....	.....	.....	.....	.....
New York	135.00	47.50	2.05	15.00	19.00	.06	.08	.07†	.10†	.055	.08	.11
Philadelphia	.....	40.00	2.02	11.00	17.00	.....	.....	.....	.....	.....	.....	.....
Pittsburgh	115.00	35.00	.....	17.00	21.00	.0675	.0875	.076†	.106†	.0575	.....	.....
St. Louis	2.80*	34.00	2.00	17.70	21.70	.065	.....	.....	.....	.035	.085	.....
San Francisco	.....	45.00	.....	12.00	18.00	12.00#	18.00‡	14.00#	21.50#	.04	.08	.12
Seattle	.....	.....	.....	16.00	21.10	.....	.....	.....	.....	.....	.....	.....

*Per sq.yd. Note: Paving asphalt, tank car or boat, f.o.b. Maurer, N. J., per ton, Bermudez, $26.00; Trinidad, $22.00. †Per gallon. ‡4½x6x5½in #Per ton.

Current Prices of Construction Materials

Iron and Steel Products—Base Mill Prices

	STRUCTURAL SHAPES-PLATE Per 100 lb., carload lots	REINF. BARS Per 100 lb., ¾-in. billet, carload lots	RIVETS Per 100 lb., ¾-in. structural carload lots	WIRE NAILS Per 100 lb., base, carload lots	SHEET PILING Per 100 lb., base, carload lots	STEEL RAILS Per Gross Ton: Standard	Light	Re-rolled	TRACK SUPPLIES Per 100 lb., carload lots: Angle bars	Std. spikes	Tie plates	Track bolts
Birmingham	$1.85	$2.00	.....	$2.10	.....	$40.00	$32.00	$31.00	$2.55	$2.40	$1.90	$3.50
Chicago	1.75	1.95	$2.60	2.10	$2.00	40.00	32.00	31.00	2.55	2.40	1.90	3.50
Pittsburgh	1.70	1.90	2.50	2.10	1.90	40.00	32.00	.....	2.55	2.40	1.90	3.50

Iron and Steel Products—Local Prices f.o.b. Warehouse

	STRUCTURAL SHAPES Per 100 lb., 15,000 lb. or over	REINFORCING BARS Per 100 lb., ¾ in., 15,000 lb., or over: New billet	Rail steel	EXPANDED METAL LATH Per 100 sq.yd., carload lots: Std. diamond mesh, 3.4 lb.	Std. ribbed 3.4 lb.	WELDED FABRIC REINF. Per 100 s.f., carload lots: 4x16 in., No. 5 & 10 wires	4x12 in., No. 8 & 12 wires	BAR MAT REINF. Per sq.yd., carload lots, 12x12 in., ¾ & ½ in. bars	SHEET PILING Per 100 lb. 15,000 lb. or over
Atlanta	$3.34	$2.17	$2.02	$18.00	$21.00	$1.60	$1.21	$1.38*	$2.45
Baltimore	2.50	2.50	2.25	18.00	20.00	1.60	1.20	.....	2.25
Boston	2.75	2.75	2.25	19.50	23.50	2.00	2.00	.24	2.33
Chicago	2.50	2.43	.....	.....	.....	1.70	1.27	.....	2.00
Cincinnati	3.25	3.00	.....	13.50	.....	.....	.....	.....	.....
Cleveland	2.45	2.45	2.45	15.40	17.40	1.62	1.22	1.98*	.....
Dallas	4.00	3.50	3.45	21.00	22.00	.....	.....	.....	.....
Denver	3.29	3.54	.....	20.50	23.50	1.90	1.40	.....	.....
Detroit	2.60	2.05	1.95	15.00	19.00	1.48	1.13	.....	2.185
Kansas City	3.10	2.80	2.55	24.50	.....	.....	.....	.....	.....
Los Angeles	3.00	2.85	.....	25.00	30.00	1.94	1.43	.....	2.50
Minneapolis	2.55†	2.54†	2.39†	17.00†	20.00†	.....	.....	.....	2.30†
Montreal	3.25	3.00	.....	.....	.....	.....	.....	.....	.....
New York	2.60	2.33	2.18	15.00	18.00	1.48	1.13	.....	.....
Philadelphia	2.60	2.30	.....	.....	.....	.....	.....	.....	.....
Pittsburgh	1.70‡	1.80‡	1.75‡	17.00‡	22.00‡	.....	.....	.....	1.90‡
St. Louis	2.75	2.20	2.20	17.00	20.00	1.46	1.12	.....	.....

*Per 100 lb. †F.O.B. City. ‡Base Mill Price.

Paints and Roofing Supplies

	WHITE-LEAD Per 100 lb. keg in oil, f.o.b.	READY-MIXED PAINT Per gal., drums, f.o.b.: Graphite*	Aluminum†	Ferric Oxide‡	ROOFING SUPPLIES Carload lots, f.o.b. city: Rolls, slate surfaced, 85-90 lb., per sq.	Asphalt felt, per 100 lb.	Tar felt, per 100 lb.	Asphalt coating, per gal.	Tar pitch, 350-lb. bbl., per ton
Atlanta	$11.75	$1.50	$1.50	$1.50	$1.77	$2.74	$2.00	$0.37	$22.80
Baltimore	11.00	.....	.....	.....	1.76	2.50	2.50	.40	30.00
Boston	11.00	1.05	1.80	1.50	6.85	2.50	2.50	.6625	23.00
Chicago	11.00	1.85	2.25	1.25	.....	.....	.....	.....	.....
Cleveland	11.00	.....	.....	.....	1.50	45.00°	45.00°	.31	18.00
Dallas	12.00	1.30	2.75	.....	1.98	.....	.....	.51	25.00
Denver	11.12½	.....	2.55	.....	2.65	3.35	3.35	.60	30.00
Detroit	11.00	1.55	2.40	1.30	1.59	2.31	2.50	.40	27.00
Kansas City	11.12½	.....	.....	.....	2.10	1.65	.....	.33	.....
Los Angeles	10.75	1.60	2.25	2.30	2.00	1.50	.....	.45	.....
Minneapolis	11.12½	.....	.....	.....	1.50	2.20	2.20	.25	24.30
Montreal	9.75	.....	.....	.....	.....	2.62	2.02	1.40§	1.63§
New York	11.00	1.58	1.95	1.35	.....	.....	.....	.....	.....
Philadelphia	11.00	.....	.....	.....	.....	.....	.....	.....	.....
Pittsburgh	11.00	1.00	1.85	.75	1.80	1.65*	1.65*	.28	23.00
St. Louis	11.00	.....	.....	.....	1.50	2.20	2.20	.24	26.00
San Francisco	10.75	.....	.....	.....	.....	.....	.....	.....	.....
Seattle	10.75	.....	.....	.....	2.25	2.40	2.40	.33	20.00

*New Jersey State Hwy. Spec. 120M. †ASTM Spec. D266-31. ‡80% maximum ferric oxide. °Per ton. §Per 100 lb. ¹Per roll.
Note: Red lead dry, same as white lead, in oil red lead in oil 50c higher.

Miscellaneous Items

WINDOW GLASS

Discounts from latest jobbers list, Sept. 15, 1928, for sizes above first three brackets

	Single or Double Thickness: A quality	B quality
Atlanta	85%	85%
Baltimore	88%	90%
Birmingham	89%	91%
Boston	88%	90%
Chicago	87%	89%
Cincinnati	.....	.....
Cleveland	75%	80%
Dallas	.....	.....
Denver	84@ 5%	86@ 5%
Detroit	87@10%	89@10%
Kansas City	89@10%	89@10%
Los Angeles	90%	90@40%
Minneapolis	84%	86%
Montreal	.....	.....
New Orleans	87@10%	90@10%
New York	87%	89%
Philadelphia	88%	90%
Pittsburgh	87%	89%
St. Louis	.....	.....
San Francisco	.....	.....
Seattle	90@10%	90@20%

*Disc. from list Aug. 1, 1929. †F.o.b. Arsenal.

EXPLOSIVES

Per lb dynamite delivered 50-lb. cases

	Gelatin: 40%	60%
Atlanta	$0.215	$0.2375
Baltimore	.21	.225
Birmingham	.15	.1725
Boston	.2225	.2375
Chicago	.17	.195
Cincinnati	.22	.245
Cleveland	.1825	.1975
Dallas	.24	.28
Denver	.19	.205
Detroit	.237	.255
Kansas City	.16	.18
Los Angeles	.1725†	.1925†
Minneapolis	.1725	.1875
Montreal	.1675	.1925
New Orleans	.19	.22
New York	.23	.245
Philadelphia	.215	.24
Pittsburgh	.1175	.1325
St. Louis	.1375	.1525
San Francisco	.1575	.1725
Seattle	.1525	.175

CHEMICALS

Water, sewage treatment, road work, f.o.b., carlots, New York:	
Bleaching powder, in drums, f.o.b. works, per 100 lb	$1.75@2.00
Calcium chloride, 77-80%, flaked, in 400-lb. drums or 100-lb. moisture proof bags, f.o.b. works, freight equalized with points of competition, per ton	19.50
Chlorine, cylinders, per lb. delivered	.05½
Silicate of soda, in drums, f.o.b. works, per 100 lb	1.65
Soda ash, 58%, in bags, per 100 lb	1.17½
Sulphate of aluminum, in 100 lb. bags	1.25@1.40
Sulphate of copper, in bbl., per 100 lb	3.75

PILES

Prices of Nichols Bros., 90 West St., N. Y. C., per linear foot, pine, with bark on, f.o.b., New York; delivered from barge, 1½ to 2c, per ft. additional:

Dimensions	Points	Length	Barge	Rail
12 in. at butt	6 in.	30 to 50 ft.	$0.09	$0.145
12 in.—2 ft. from butt	6 in.	50 to 59 ft.	.13	.195
12 in.—2 ft from butt	6 in.	60 to 69 ft.	.15	.215
14 in.—2 ft. from butt	6 in.	50 to 69 ft.	.185	.225
14 in.—2 ft. from butt	6 in.	70 to 79 ft.	.2025	.225
14 in.—2 ft. from butt	5 in.	80 to 85 ft.	.265	.375
14 in.—2 ft. from butt	5 in.	85 to 89 ft.	.305	.442

RAILWAY TIES

Prices f.o.b., per tie, for carload lots:

		6 In. x 8 In. by 8 Ft.	7 In. x 9 In. By 8½ Ft.
Boston	Oak, untreated	$0.90	.....
	Pine, untreated	.90	.....
	Pine, creosoted	1.35	.....
New York	Long-leaf sap pine, untreated	.80	$1.00
	Mixed oak, untreated	.....	1.00
	White oak, untreated	.75	1.50
Birmingham	White oak, creosoted	1.40	1.45
	Southern pine, untreated	.35	.60
	Southern pine, creosoted	.95	1.35
	White oak, untreated	1.05	1.35
Chicago	Oak, empty cell, creosoted	1.40	1.80
	Oak, zinc treated	1.25	1.65
	Southern pine, creosoted	1.15	1.50
Los Angeles	Fir, untreated	.70	.95
	Fir, creosoted	1.90	2.70
Philadelphia	Red oak, untreated	.95	1.15
	Red oak, creosoted	1.47	1.90
	White oak, untreated	1.00	1.45
St. Louis	Red oak, untreated	.90	1.35
	Red oak, creosoted	1.30	1.85
	Sap Pine or cypress, untreated	.75	1.15
San Francisco	Douglas fir, green, untreated	.45	.63
	Douglas fir, empty cell, creosoted	1.14	1.56
Montreal	Birch or maple, untreated	1.00	1.00
	Birch or maple, creosoted	1.25	1.55

Current Prices of Construction Materials

Water, Sewer and Drain Pipe

	C. I. PIPE Per net ton, f.o.b. 6 in. and over b. & s. class B and heavier carload lots*	VITRIFIED SEWER PIPE Per foot, delivered, standard 8 in., s.s.	12 in., s.s.	24 in., d.s.	36 in., d.s.	CLAY DRAIN TILE Per 1,000 ft., carload lots, f.o.b. 6 in.	8 in.	CONC. SEWER PIPE Per ft., delivered; ASTM Spec. C 14-24 12 in.	24 in.	WROUGHT STEEL PIPE Full std. weight. Discounts from standard list for delivery from warehouse, except Pittsburgh prices are f.o.b. mill. Base price $200 per net ton. List prices per ft.: ¼ in., 9c; ⅜ in., 12c.; 1 in., 17½c.; 2 in., 37½c.; 2½ in., 59c.; 3 in., 77c.; 4 in., $1.10; 6 in., $1.94. 1 to 3 in., Butt Weld Black	Butt Weld Galv.	2½ to 6 in., Lap Weld Black	Lap Weld Galv.
Atlanta	$36.00	$0.225	$0.405	$1.4625	$3.28	$80.00	$128.00	$0.625	$1.625	52%	44.5%	50%	42%
Baltimore	38.50	.26	.50	2.20	4.50	85.00	150.00	.50	1.50	.....	.....	.....	.....
Birmingham	32.00	.30	.54	1.95	5.00	.....	.....	.....	.....	.....	.....	.....	.....
Boston	40.50	.28	.54	2.80	7.175	60.10	101.00	.432	1.935	55.59%	44.83%	56.85%	46.10%
Chicago	40.00	.35	.675	2.25	5.125	120.00	.....	.....	.....	.....	.....	.....	.....
Cincinnati	39.00	.....	.2835	1.125	1.125	.....	.....	.....	.....	.....	.....	.....	.....
Cleveland	40.50	.203	.3915	1.755	6.355	42.50	88.50	.....	.....	53.3%	42.3%	50.8%	37.8%
Dallas	44.00	.30	.54	2.15	.....	99.00	.....	.....	.....	.....	.....	.....	.....
Denver	52.00	.23‡	.415‡	1.73‡	.....	100.50‡	.....	.....	.....	.....	.....	.....	.....
Detroit	40.50	.28	.54	2.25	.....	100.00	150.00	.....	.....	.....	.....	.....	.....
Kansas City	42.00	.335	.52	1.90	3.80	120.00	180.00	.....	.....	.....	.....	.....	.....
Los Angeles	40.50	.2825‡	.508‡	2.03‡	5.535‡	115.50	192.50	1.00	2.00	.....	.....	.....	.....
Minneapolis	42.50	.215‡	.287‡	1.548‡	4.35‡	64.90	120.00	.....	.....	53%	42%	54%	43%
Montreal	.....	.....	1.02	3.64	.....	.....	.....	.....	.....	.....	.....	.....	.....
New Orleans	38.00	.....	.50	1.90	.....	45.00	.....	.....	.....	.....	.....	.....	.....
New York	38.00	.315	.6075	2.565	5.8425	.....	.....	.45	2.00	56.164%	45.144%	57.389%†	46.368%†
Philadelphia	36.50	.126	.243	1.17	4.615	.....	.....	.....	.....	57.28%	44.68%	53.28%	41.80%
Pittsburgh	41.00	.175‡	.3375‡	1.53‡	4.8175‡	47.00	83.00	.75	1.75	67.5%	58.5%	68.5%†	59.5%†
St. Louis	39.00	.26	.468	2.85	3.96	85.00	195.00	.....	.....	55.53%	44.52%	56.76%	45.75%
San Francisco	40.00	.25	.45	1.80	4.50	112.00	.....	.....	.....	.....	.....	.....	.....
Seattle	41.50	.275	.54	2.00	5.50	.....	.....	.....	.....	.....	.....	.....	.....

*Gas pipe and class A, $3 per ton additional. 4-in., $3 per ton additional. †3½ to 6 in. ‡f.o.b.

Lumber and Timber

		SHORT LEAF YELLOW PINE AND DOUGLAS FIR Per M ft. b.m., carload lots f.o.b. All S. L. Y. P. is No. 2 common or better and for No. 1 N. C. Box. All Fir planks No. 2 common; Fir timber is No. 1 common. S. L. Y. P. lumber is 10 to 20 ft. Fir lumber is up to 20 ft. 1x6, S4S	1x8, S4S	2x4, S4S	2x6, S4S	2x8, S4S	2x10 S4S	3x12 Rgh	6x12 Rgh.	12x12, Rgh.	LONG LEAF Y. P. Per M ft. b.m., carload lots, f.o.b., merchantable grade up to 20 ft. 2x12, Rgh.	12x12, Rgh.
Atlanta	Southern Pine	$20.00	$20.00	$17.50	$17.50	$17.50	$22.50	$27.50	.....	.....	$45.00	$50.00
Baltimore	Southern Pine	26.00	26.50	24.50	24.50	26.00	29.00	31.00	.....	.....	60.00	58.00
	Douglas Fir	25.50	27.00	26.50	26.50	27.00	27.00	33.50	$31.50	$30.50	.....	.....
Birmingham	Southern Pine	40.00	40.00	.....	.....	.....	.....	50.00	.....	55.00	.....	.....
Boston	Southern Pine	30.00	31.00	38.00†	38.00†	60.00‡	75.00‡	70.00‡	.....	.....	70.00	70.00
	Douglas Fir	31.00	31.00	35.00	35.00	37.00	39.00	42.00	42.00	42.00	.....	.....
Chicago	Southern Pine	40.00§	43.00§	46.00§	46.00§	46.00§	50.00	56.00	56.00	56.00	66.50	82.00
Cincinnati	Southern Pine	28.00*	28.00*	.....	.....	.....	.....	35.00*	.....	35.00*	.....	.....
	Douglas Fir	.....	.....	.....	.....	.....	.....	42.50*	.....	42.50*	.....	.....
Cleveland	Southern Pine	39.00	44.00	44.00	41.00	41.00	48.00	52.00	.....	.....	60.00	70.00
	Douglas Fir	39.00	44.00	44.00	41.00	41.00	48.00	60.00	60.00	60.00	.....	.....
Dallas	Southern Pine	28.00	29.00	33.50	31.00	33.50	37.50	47.50	.....	.....	52.50	60.00
	Douglas Fir	32.50	30.00	36.50	34.00	36.50	41.50	52.50	55.00	55.00	.....	.....
Denver	Douglas Fir	33.00	33.00	40.00	40.00	40.00	43.00	51.00	58.00	.....	.....	.....
Detroit	Southern Pine	30.00	32.00	31.00	31.00	30.00	33.00	40.00	.....	.....	39.00	49.00
	Douglas Fir	.....	.....	.....	.....	.....	.....	44.00	49.00	47.00	.....	.....
Los Angeles	Douglas Fir	30.00	30.00	30.00	30.00	30.00	33.00	31.00	35.00	38.00	.....	.....
Minneapolis	Western Pine	42.00	42.00	36.00	36.00	36.00	38.00	42.50	.....	.....	.....	.....
	Douglas Fir	29.50	29.50	29.50	29.50	29.50	37.50	39.50	39.50	42.50	44.00	42.50
Montreal	Spruce	27.00	29.00	21.00	23.00	24.50	31.50	34.50	.....	.....	.....	.....
	Douglas Fir	48.00	51.00	45.00	50.00	53.00	62.00	.....	.....	.....	.....	.....
New Orleans	Southern Pine	18.00	19.00	.....	.....	.....	.....	30.00	.....	.....	.....	.....
	Douglas Fir	21.00	21.00	.....	.....	.....	.....	42.50	.....	.....	.....	.....
New York	Southern Pine	33.00	34.00	35.00	35.00	35.00	37.00	36.00	.....	.....	70.00	70.00
	Douglas Fir	.....	.....	38.00	36.00	37.00	37.00	36.00	40.00	40.00	.....	.....
Philadelphia	Southern Pine	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	Douglas Fir	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Pittsburgh	Southern Pine	26.50	27.50	26.50	26.50	27.50	29.50	39.50	.....	.....	53.50	53.50
	Douglas Fir	32.50	32.50	36.50	36.00	36.00	38.00	45.00	45.00	45.00	.....	.....
St. Louis	Southern Pine	32.00*	35.00*	32.00*	30.00*	31.50*	40.00*	47.50*	.....	.....	59.00*	59.00*
	Douglas Fir	.....	.....	.....	.....	.....	.....	55.00*	55.00*	55.00*	.....	.....
San Francisco	Douglas Fir	28.00	28.00	28.00	28.00	28.00	29.00	30.00	31.00	31.00	.....	.....
Seattle	Douglas Fir	19.50	19.50	.....	.....	.....	.....	21.50	.....	22.50	.....	.....

*Delivered. †Spruce. ‡Long-leafed Y. P. §No. 1 Pine.

Current Building and Construction Wage Rates Per Hour

	Bricklayers	Carpenters	Structural Iron Workers	Hoisting Engineers	Plasterers	Common Labor Building	Common Labor Heavy Const.
Atlanta	$0.75/1.125	$0.40/.90	$0.60/1.25	$0.60/1.25	$0.50/.75	$0.30	$0.30
Baltimore	1.00	.65	1.00	1.00	1.25	.25	.25
Birmingham	.75/.87½	.60	.75	.75	.....	.25/.30	.25/.30
Boston	.90/1.30	.70/1.17½	1.20	.90/1.17½	.90/1.62½	.40/.70	.40/.70
Cincinnati	1.27½	1.02½	1.20	1.07½	.....	.45	.40
Chicago	1.50	1.31½	1.35	1.31½	1.37½	.82½	.82½
Cleveland	1.25	1.12½	1.25	1.12½	1.25	.72	.72
Dallas	1.12½	.875	1.00	1.00	1.125	.40	.40
Denver	.60/1.12½	.60/.87½	.60/.87½	.60/.87½	.....	.50	.50
Detroit	1.00	.50/.70	1.00	.70/.90	.60/1.25	.35/.50	.35/.50
Kansas City	1.32½	1.12½	1.12½	1.12½	1.32½	.70	.40/.60
Los Angeles	.90	.75	1.12½	.75	.90	.45	.60
Minneapolis	1.25	.75	.90	.75	.90	.40	.50
New Orleans	1.00	.75	1.00	1.00	1.25	.30/.40	.30/.40
New York	1.50/1.65	1.25/1.40	1.65	1.50/1.65	1.50	.93¾	.62½/.82½
Philadelphia	.75/1.00	.50/.75	.75/100	.75/1.00	.....	.35	.30
Pittsburgh	.50/1.50	.50/1.25	.50/1.37½	.50/1.37½	.50/1.25	.35/.70	.35/.70
St. Louis	1.50	1.25	1.47	1.35/1.47	1.50	.78¾	.78¾
San Francisco	1.12½	.90	1.20	1.00	1.10	.60	.60
Seattle	.75/1.20	.50/.90	1.10	1.00	.....	.40/.50	.40/.50
Montreal	1.20	.55	.85	.85	.85	.30	.20

Skilled Ave. (Bricklayers, Carp., Ironworkers) $1.029. Common Ave. $0.5057.